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THE RECENT TRANS-AFRICAN FLIGHT AND ITS LESSON

By LIEUTENANT LEO WALMSLEY, M.C., late R.A.F.

When, at the end of 1918, the termination of the war with Turkey released the energies of the British Royal Air Force in the Middle East for other tasks, Major-General W. G. H. Salmond, the commanding officer, decided upon the examination and equipment of several long-distance air routes as a means of promoting peace-time aviation. One of these routes, over which he personally made a flight in December, 1918, was from Egypt to India by way of Palestine, Bagdad, the Persian Gulf, and the coast of Baluchistan. Another was a continuation of this route from India to Australia. Even before it was completely examined this route was traversed by way of the Malay Peninsula and the East Indies in November and December, 1919, by Captain Ross Smith of the Australian Flying Corps in his successful flight from England to Australia.[1] The third route was from Cairo to Cape Town (cf. map, Fig. 1).

THE RECENT CAIRO-CAPE TOWN FLIGHT

The opening of this route to airplane traffic was announced by the British Air Ministry late in December, 1919.[2] Within two months four airplanes started on the flight. Two of these did not get beyond the first stage of the journey, one being forced to come down between Aswan and Wady Halfa on the middle Nile, the other crashing to earth near Shereik station below the mouth of the Atbara. The third, a machine flying under the auspices of the *London Times* and piloted by Captain S. Cockerell and Captain F. C. Broome, was the first to depart. It left Cairo on February 6.

[1] For a discussion of the meteorological conditions on this route see Griffith Taylor: Air Routes to Australia, *Geogr. Rev.*, Vol. 7, 1919, pp. 256-261.—EDIT. NOTE.

[2] For an account of the laying out of the Cairo-Cape Town air route see: Cape to Cairo by Air: How the Route Was Prepared Over Bush and Jungle, *African World*, Jan. 3, 1920, p. 389, and W. T. Blake: From Cairo to Cape Town: Working on the African Air Route, *ibid.*, pp. 390-391. The course of the flights can be followed in the weekly issues of the *African World* from February 7 (with map in supplement) to March 27 and of the *London Times: Weekly Edition* from February 6 (map in illustrated section) to March 26.—EDIT. NOTE.

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Proceeding in gradual stages, which were marked by a series of forced landings because of engine trouble, it reached Khartum on February 7, Mongalla on the White Nile on February 14, Jinja on the northern shore of Victoria Nyanza on February 22, finally meeting its fate, fortunately with no fatality to its occupants, at Tabora, Tanganyika Territory (formerly German East Africa), on February 27. The fourth airplane, the *Silver Queen,* piloted by Lieutenant-Colonel P. van Ryneveld and Lieutenant C. J. Quintin Brand, two South African officers of the Royal Air Force, left Cairo on February 10 and came to grief the next day at Korosko between Aswan and Wady Halfa. Using a second machine, the *Silver Queen II,* placed at his disposal by the South African Government, Colonel van Ryneveld started anew from Cairo on February 22. Khartum was reached on February 23, Mongalla on February 25, Kisumu on the northeastern shore of Victoria Nyanza on February 26, Abercorn at the southern end of Lake Tanganyika on February 28, Livingstone on March 2, and Bulawayo on March 5. Shortly after leaving Bulawayo the next day the airplane was wrecked. The aviators remained here pending the arrival of a new machine sent from Cape Town and on this, the *Voortrekker* (Pioneer), left Bulawayo on March 17, reaching Pretoria on the same day and Cape Town on March 20, thus successfully completing the flight.

Distances and Flying Time

The actual flying time between Cairo and Cape Town, a distance of 5,206 miles by the air route, had been 72 hours and 40 minutes, and the average speed therefore about 72 miles an hour. Colonel van Ryneveld's flight had really begun on February 4 from the Brooklands aerodrome near London, whence he reached Cairo on February 9 by way of Turin, Rome, Apulia, the Ionian Islands, and Derna. The total distance from London to Cape Town, traversed in three airplanes, was about 7,600 miles, covered in 4 days, 13 hours, and 30 minutes of actual flying time. The flight of the *Times* machine had likewise begun at Brooklands, on January 24, Cairo being reached on February 3 by way of Lyons, the mouth of the Rhone, Rome, Malta, Tripoli, and Benghazi. The total distance between London and Tabora by this route was 5,378 miles, 2,628 of which represented the distance between Cairo and Tabora, covered in 36½ hours of actual flying time.

Difficulties of the Trip

These events have clearly demonstrated that trans-African airplane flight is a far more difficult undertaking than it was first considered to be. The series of mishaps that overtook all of the aspirants—even the successful—for the honor of being the first to fly from Cairo to Cape Town seems to prove that from the commercial point of view a regular transcontinental airplane service under present conditions is impracticable.

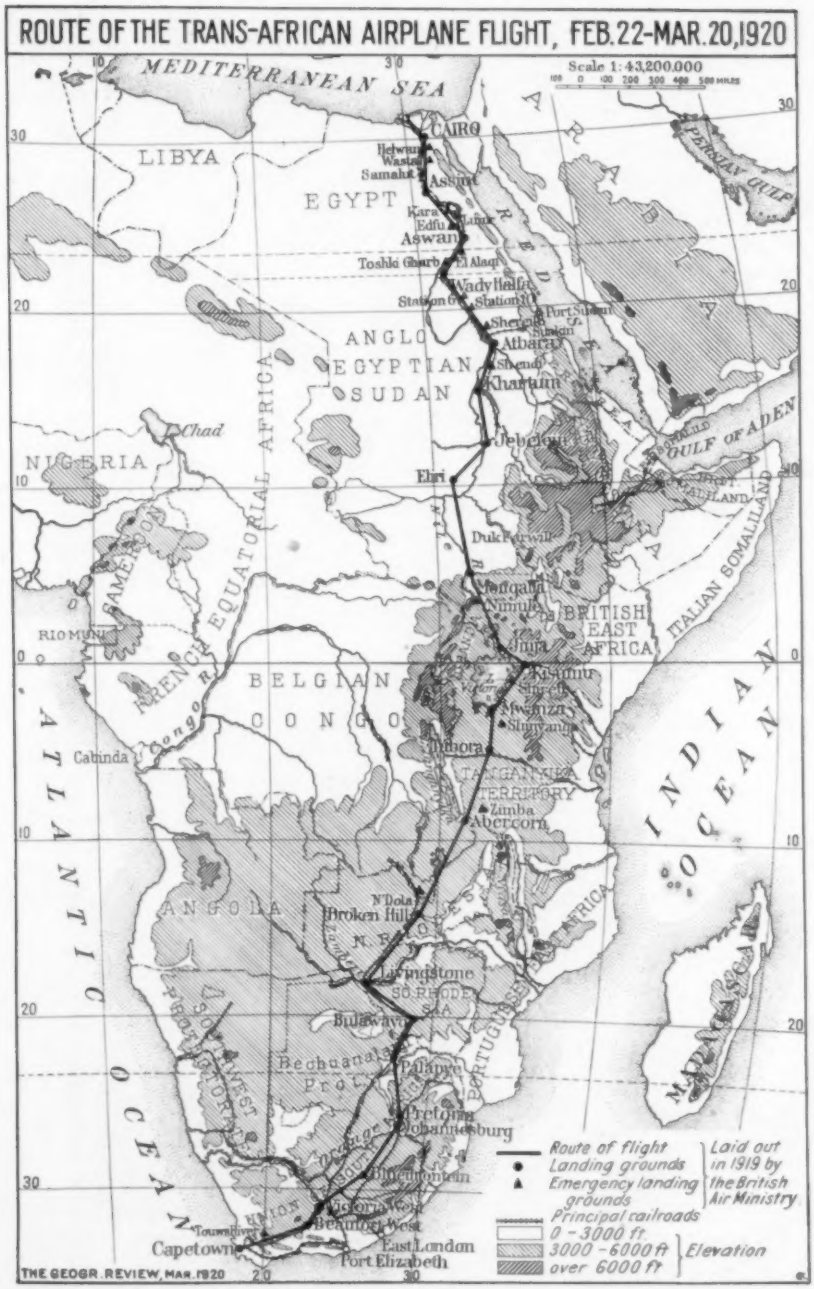

ROUTE OF THE TRANS-AFRICAN AIRPLANE FLIGHT, FEB. 22-MAR. 20, 1920
Scale 1:43,200,000
MEDITERRANEAN SEA
CAIRO
LIBYA
EGYPT
ARABIA
PERSIAN GULF
RED SEA
Aswan
Wadi Halfa
Port Sudan
Atbara
Khartum
ANGLO EGYPTIAN SUDAN
Chad
NIGERIA
Obudu
Elgon
Eldoret
Nairobi
BRITISH EAST AFRICA
ITALIAN SOMALILAND
GULF OF ADEN
FRENCH EQUATORIAL AFRICA
CAMEROON
RIO MUNI
BELGIAN CONGO
Congo R.
Kisumu
Mwanza
Shinyanga
Tabora
Calinda
TANGANYIKA TERRITORY
Zumba
Abercorn
INDIAN OCEAN
ATLANTIC OCEAN
ANGOLA
N'Dola
Broken Hill
N. RHODESIA
Livingstone
S. RHODESIA
Bulawayo
Bechuanaland Prot.
Palapye
PORTUGUESE EAST AFRICA
MADAGASCAR
Pretoria
Johannesburg
Orange R.
Bloemfontein
Victoria West
Beaufort West
Touwsrivier
Capetown
East London
Port Elizabeth
Route of flight
Landing grounds
Emergency landing grounds
Principal railroads
0 - 3000 ft.
3000 - 6000 ft.
over 6000 ft.
Laid out in 1919 by the British Air Ministry
Elevation
THE GEOGR. REVIEW, MAR. 1920

FIG. 1

On the newspaper map it looks very simple—a straight line between Cairo and Khartum, Khartum and Mongalla, and so on down to Cape

FIG. 2—Mouth of the Rufiji River, East Africa, from an airplane.

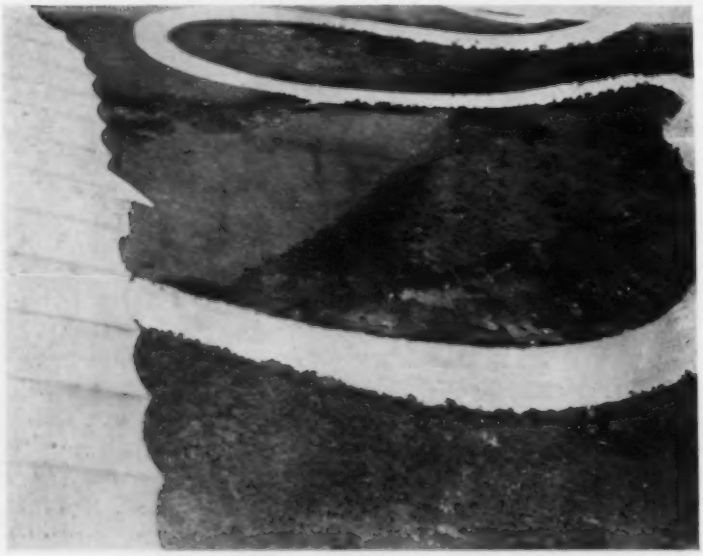


FIG. 3—Meanders of an East African river. (Part of airplane wing on left).

Town. But unfortunately these maps, so freely circulated of late, supply but the scantiest information regarding the geographical and other condi-

tions that are of real importance to airmen. Few maps show that two-thirds of the route chosen by the Air Ministry runs across country 3,000

FIG. 4—Mangroves fringing the shore.

FIG. 5—The real tropical forest. Note the clearing in center background.

to 6,000 feet above sea level; that the country is clad for the greater portion in dense bush and forest; that temperature conditions range from

extremes of intense damp heat to cold as severe as in northern Europe. They tell one nothing of the fierce winds that howl over the tropical highlands at certain times of the year, of the thunderstorms and rains that will transform the sun-baked veld into a lake in fifteen minutes; of the dense cloud banks that envelop mountain ranges for months at a time; of the mists that hang over valleys and swamps and render the landing of an airplane an operation fraught with the greatest danger.

The general trend and details of the great chain of aerodromes constructed by the Air Ministry across Africa may be gathered from the accompanying map. For the purpose of this article I shall divide the route into three great sections; first, the Egyptian, from Cairo to Khartum (1,040 miles); second, the central, from Khartum to Livingstone (2,600 miles); and third, the South African, from Livingstone to Cape Town (1,560 miles).

The preparation of these aerodromes has been a costly and difficult undertaking, particularly in the central and South African sections. In certain districts it was found necessary to hew down great patches of forest in order to make enough clear space, and even then the ground had to be cleared of termite heaps and leveled by hand before an airplane might land in safety. In the *sudd* country of the upper Nile, an area of 35,000 square miles, the difficulty was to find a suitable piece of dry ground. In the Egyptian section the work was not so difficult, as the flat valley of the Nile naturally afforded hundreds of suitable sites.

But, if aerodromes were the only problem, any airplane capable of flying 350 miles might make the flight. The aerodromes are, as a matter of fact, as good, and probably better than those found in England, and they are certainly superior in size, surface, and approach to the best that we had during the East African campaign. In those days we considered a rectangle measuring 200 by 600 yards a veritable Salisbury Plain.

Air Conditions

On the face of things, the Egyptian section should not present any special difficulties to an up-to-date high-powered airplane, provided that reasonable precautions in regard to loading are taken and that during the heat of the day the machine is kept at a good altitude. Under 2,000 feet heat gusts may be expected, and they are sufficient to impose a great strain, not only on the structure of the machine but also on the physical powers of the pilots. From what one can gather, the Handley-Page that crashed at Shereik was almost shaken to pieces by these atmospheric disturbances, and the crew were indeed fortunate to escape with their lives.

These heat gusts, bumps, or air pockets, as they are variously termed, naturally grow worse in the vicinity of the equator, and in the central section they become a very serious problem indeed. The heat gusts usually take the form of vertical currents or columns which rise to a height vary-

ing from 100 to 2,000 and even 3,000 feet. Frequently these columns rotate, and they rise with such force as to suck up clouds of dust, sand, leaves, and other vegetable débris. On a hot day it is quite common to see a score of these "dust devils" within an area of a few square miles, and their effect on an airplane may be imagined. It was quite a usual experience while flying in Central Africa to be shot up suddenly a thousand feet or more without a second's warning, for it does not always follow that the currents are visible. When they occur over rocks or hard, sun-baked country naturally they contain no dust.

FIG. 6—Landing an airplane hangar on Lake Nyasa.

Compensating the upward currents of warm air, columns of cold air fall with corresponding force; and these, which are always invisible, are apt to be more dangerous. If an airplane about to land encounters a big "pocket," there is every chance of its dropping straight to the ground. The writer saw three machines wrecked in this way on the East African coast.

The only sure way to avoid air gusts is to fly either at night, early morning, or late afternoon, or to maintain an altitude of at least 8,000 feet throughout the hottest hours of the day. Even at this height near mountains or in the shadow of clouds air gusts may still be expected.

It is no exaggeration to say that flying an airplane at a low altitude during the heat of the day in Central Africa is harder work than holding the helm of a fishing yawl in a heavy northeaster.

EFFECT OF ALTITUDE

Added to this problem of gusts we find, in the central and South African sections, another problem—that of altitude. I have already referred

to the great tableland that occupies the whole of the center of Central and South Africa. On an average it lies between 3,000 and 6,000 feet above sea level, and the atmosphere is consequently very rarified and lacking in buoyancy. This, coupled with the "thinning" effect of the sun's heat, makes it extremely difficult to get an airplane into the air; and the strain on the engine is so great that it may give out just at the most critical moment—precisely what happened with the *Times* machine at Tabora. Colonel van Ryneveld, who flew 3,880 miles of the journey from Cairo before his machine crashed at Bulawayo, experienced great difficulty at Abercorn (5,650 feet), the highest landing ground on the route, where he had to discard everything not absolutely essential in order to be able to leave the ground.

The effect of altitude diminishes slightly towards the southern end of Africa; but, unless a new route either by way of the eastern or western coast be chosen or unless higher-powered and greater-winged surface craft be used, there is no avoiding it.

The Type of Engine To Be Used

An analysis of the log books of the persons who attempted the flight would show that the main causes of failure were engine troubles. I am not enough of an engineer to deal with this side of the problem; but I think it is worth noting that in two years' experience of flying in all quarters of Central Africa we found that the ordinary air-cooled engine was infinitely more reliable than those of the water-cooled type, and it possesses the inestimable advantage of lightness. The engines employed in all the machines entered for the Cape Town flight were water-cooled and were supposed to be absolutely the best so far as design and workmanship went. It must be remembered, however, that they were fitted to heavy machines carrying full loads and that the strain borne by them while flying through rarified and gusty air was tremendous.

Weather Difficulties

In addition to the ordinary atmospheric conditions, which in the central section do not vary, we have another serious problem in the weather. This in Africa is a better-known quantity than in England, for the rainy seasons and dry seasons occur with little irregularity. Unfortunately for the would-be traveler from Cairo to the Cape they do not occur at the same time throughout the route but at such periods of the year as to make it almost impossible for an airplane to have fine weather all the way. To fly across Central Africa in its rainy season is no easy matter, for never a day passes without a thunderstorm and a torrential downpour of rain sufficient, as I have already said, to turn the veld into a lake within a few minutes. In the air these storms may usually be dodged; but an airplane, unless it carries a sufficient margin of fuel, may be driven so far out of its

course as to make a forced landing necessary. A forced landing in this part of the world is full of possibilities, among which an undamaged machine is not the only one; for a landing ground, in the ordinary meaning of the word, does not exist. Practically the whole country lying between Mongalla and Livingstone consists of rolling veld or mountains clad almost without break in dense bush and forest. Even the most seductive grassy glades are pitted with termite heaps, and it is infinitely more dangerous to crash into one of these while making an otherwise good landing than to "pancake" deliberately into the bush when the branches and foliage,

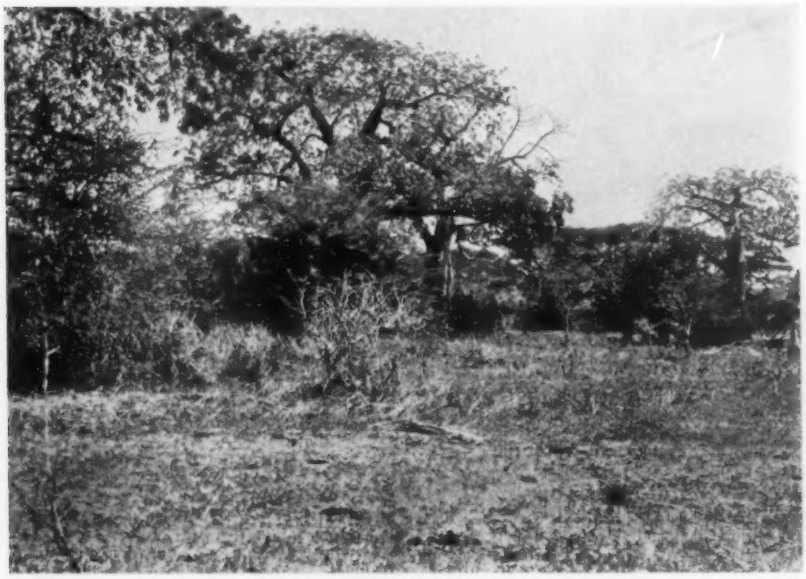


FIG. 7—Typical "bush" country with baobab trees.

though wrecking the machine, usually break the fall of the occupants. Granted that the airmen escape safely from the crash, they may find they have only jumped from the frying pan into the fire. The country they have landed in may be entirely waterless; it is probably infested with lions, buffaloes, and rhinos; and, unless they are armed, they may find the march to the nearest camp, aerodrome, or village as full of adventure as a Jules Verne romance.

UNSUITABILITY OF AIRPLANES TO COMMERCIAL TRAFFIC

In spite of all these natural obstacles with which Dark Africa guards the secrets of her heart, Colonel van Ryneveld's success shows that the through journey can be made. At the same time, I am convinced that for a regular trans-African service the airplane, even when worked in relays,

is not a practicable commercial undertaking. It has been clearly proved that the heavy type of airplane is not suitable for the tropics; and the lighter type would not have sufficient cargo space to make it pay. The cost of the various relay stations, the transport of fuel and spare parts, the upkeep of the aerodromes and emergency landing grounds would be enormous and out of all proportion to the profits received from express, mail, and passenger traffic. The risk of forced landings would never be entirely eliminated, and the average business man would, I think, prefer a week's

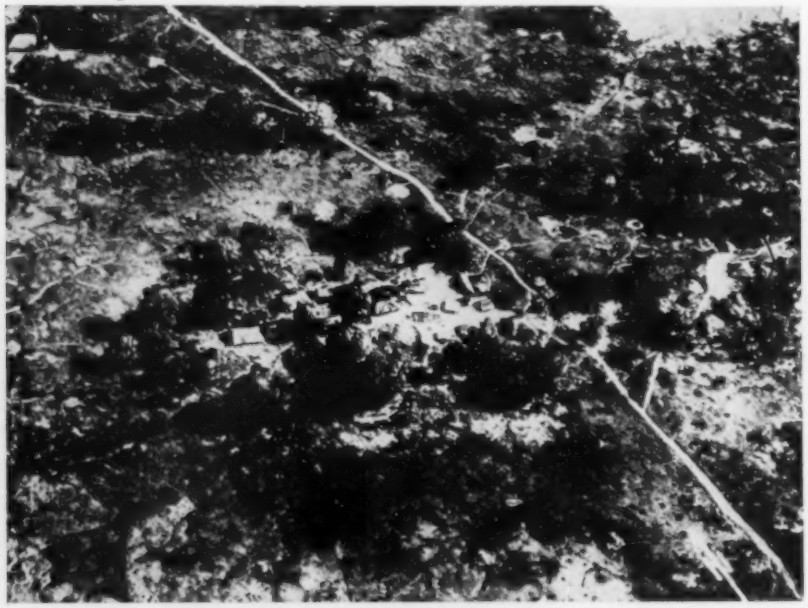


FIG. 8—A native village seen from the air.

delay in sending an urgent letter to the risk of losing it completely. The perfection of wireless telephony will rob the airplane of its advantage as a letter carrier.

SUITABILITY OF AIRSHIPS

With the airship things are different. Here we have a machine capable of carrying a useful load and of flying enormous distances without the necessity of landing. Because of its independent buoyancy and its numerous engines and their accessibility nothing short of a total collapse would bring it to earth without the will of its occupants. But the airship presents many problems of its own. The effect of the tropical sun on the envelope would probably be very great. The expansion of gas due to the changing temperatures would be a matter demanding much thought. If an airship could maintain a height of over 8,000 feet while flying over the

tropical zone, no trouble should be experienced from gusts. The actual temperature of the air at this height is practically the same all over the world; and, if some fabric absolutely impervious to the sun's heat rays could be evolved, there would be no trouble from expansion.

In the writer's opinion, the only regular air service across Africa would be one of giant airships. It will probably be organized in three stages: the first from Cairo to Khartum, the second from Khartum to Livingstone, and the third from Livingstone to Cape Town. Sheds would be required

FIG. 9—Dar-es-Salaam, Tanganyika Territory.

only at Khartum and at Livingstone, as a protection from the heat; at Cairo and Cape Town mooring masts would be sufficient. For the first and third stages any modern type of Zeppelin would do; but for the central zone a specially constructed high-powered, sun-resisting craft would be required, capable of climbing to 15,000 feet and maintaining this height throughout the journey to Livingstone. In East, Central, and South Africa this airship service might be linked up with airplanes, and mails might be carried to their destination in one-half the time taken at present.

THE WONDER OF THE AFRICAN AIRSCAPE

If ever a Cairo-to-Cape Town air service is inaugurated, there should be no dearth of sight-seeing passengers; for Africa as seen from the air is one of the most wonderful of all countries. The flight up the Nile

would alone be an experience to talk about until one's dying day; and there is hardly a square mile of country lying between the northern and southern extremities of Africa that has not its special interest. The central portion of the route lies over a land which even yet is a sealed book so far as the white man is concerned; over vast stretches of country where the only roads are those made by roving elephants or countless herds of antelope, zebra, and giraffe; over regions of scenery absolutely unrivaled in its loveliness. A civilized country seen from the air is simply a gigantic mosaic, monotonous in its regularity; but the airscape of Central Africa is as untamed and irregular as that of the moon. Except in the rainy season fogs or mists are unknown, and only the curving of the earth limits the range of visibility. The view over the rolling sunlit veld, with its rounded kopjes and winding silver rivers, its mysterious marshy lakes, and its stupendous snow-capped mountains, is something never to be forgotten. Probably many of these scenes will be filmed, and the public may see them as it has seen the wonders of the Antarctic and the South Sea Islands—in the easy comfort of a plush-backed chair. Yet no camera or artist can ever faithfully portray the magic wonders of the African air. Only to those who are bold enough or, what is perhaps more important, rich enough to go and see for themselves will they be revealed.

PEARY: AN APPRECIATION

By HERBERT L. BRIDGMAN

A true interpretation of Admiral Peary's almost quarter-century of life work reveals it as but another, more forceful and rigorous presentation of the age-long drama in which man and nature, mind and matter are arrayed against each other. True to classic model, but penetrating much farther than did the ancient dramatists into mysteries physical and spiritual, Peary's drama was a trilogy, each part independent, self-sustaining, and to a degree complete, yet each, as the result proved, related to the others, preparing the way for the next, and all inspired and united by a common idea, a definite objective, and a continuous purpose. Some day, when the psychology of adventurers and particularly of Arctic adventurers comes to be studied and understood, it will be found that Peary's contributions, intellectual and spiritual, to the sum of human knowledge were no less valuable and memorable than were those that have been made in better known and more definitely limited fields of science, and that humanity, no less than his country, is his lasting debtor. Our present path, however, does not lie in that direction.

Peary's Contribution to the Method of Polar Exploration

Nevertheless it is pertinent to say that Peary's contributions, definite at the beginning and emphasized as the years went on and experience conformed to the plan and scope and the method and management of polar field work, were both in immediate and ultimate value second only in importance to his attainment of the Pole itself. Radical and revolutionary to the extreme, fortified only by clear Yankee common sense and the courage of his convictions, Peary, breaking all precedents and relying on his own judgment and a keen perception of the relation of means to ends, discarded at the outset the large party for the small, the ship for the land, and civilized for Eskimo modes of travel. In short he adapted himself and his party to actual conditions and environment, took the Eskimos as friends and instructors, made their customs and dress his own, and at one step mastered all that generations of human experience had to contribute in the great adventure on which he had embarked. Whether American or Eskimo was the base of the composite does not matter. No chemical "third something" ever served its purpose more thoroughly and successfully than the combination thus formed by Peary; and it is certain that to his complete understanding and masterly treatment the potency of the union was wholly due. No less a factor in progress and ultimate success was Peary's intense and dominating personality; under orders from no department or bureau, he

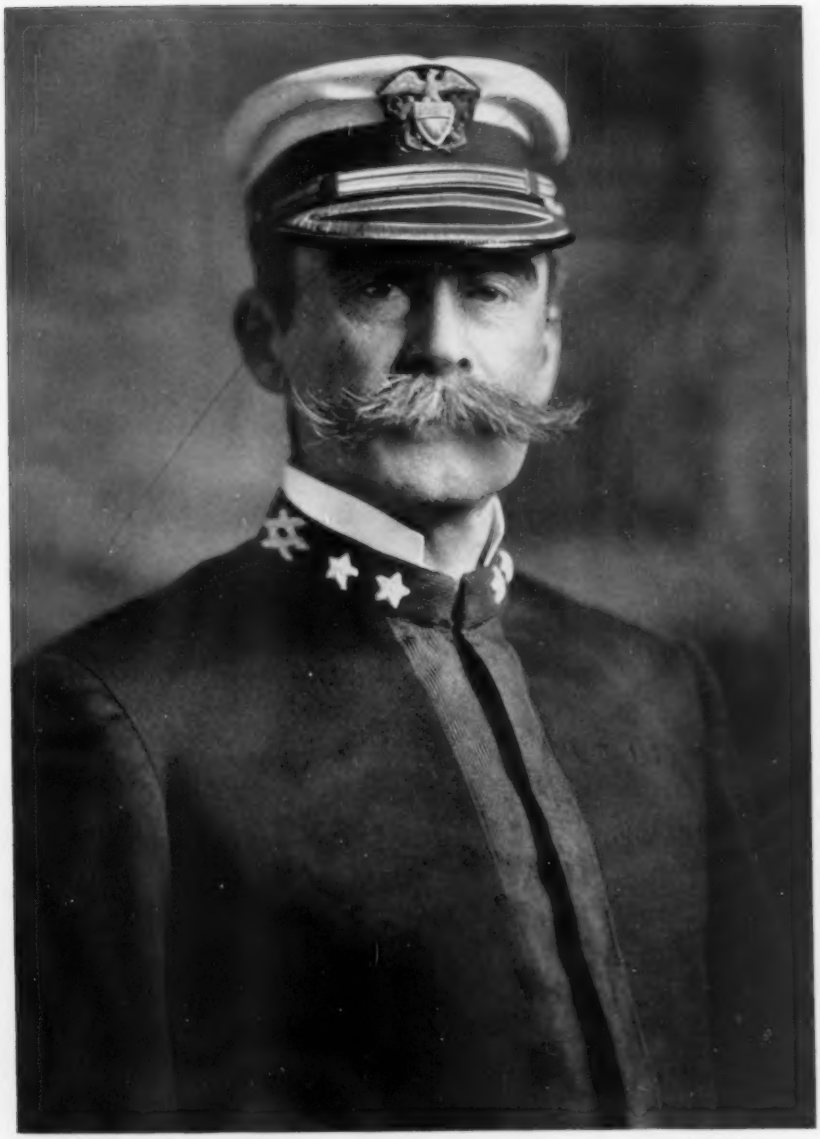
was responsible only to himself and his sense of duty, and, had outside authority intervened, no prophet was needed to foretell the consequences. Not only do Peary's reasoning and methods, including his long and exhausting tests, explain his final success on that ever memorable sixth of April, 1909; but Amundsen at the opposite pole, December 16, 1911, two years and eight months later, Stefansson's five years in the Canadian Arctic Archipelago, the Scott and Shackleton tragedies resulting from adherence to other methods—all are additional proof, if any were needed, not only of the absolute correctness of Peary's methods but of their vast and decisive importance in all the Polar work of the future. The magnetic needle is scarcely a more valuable aid to the navigator than is the equipment which Peary has bequeathed to every one who follows him.

Peary's Expeditions

The Peary drama—"Conquest of the Pole" he prophetically named it almost before it was begun—readily and naturally separates itself into a trilogy. Part One consists of the Inglefield Gulf expeditions and the four traverses of 2,500 miles of the great Greenland ice cap (1891-1895); Part Two, the Peary Arctic Club's first series of expeditions (1898-1902), including the rounding of North Greenland and the elimination of that island as a possible route under any circumstances to the Pole; and Part Three, the Peary Arctic Club's second series of expeditions (1905-1909), including the building of the *Roosevelt*, the advance to 87° 6′ N., the return disabled and almost a floating wreck, and the second voyage (1908-1909), culminating April 6 and announced September 9 in the Battle Harbor radiogram "Stars and Stripes nailed to the North Pole" which electrified the civilized world. Within these few sentences are contained outlines of a story since familiar and always to be familiar to the world, deeds recognized and accorded the highest honors by geographical and other scientific societies, a landmark in history—since it takes the word "unknown" from one part of the globe forever.

Survey of His Scientific Results

A survey of the more definite and distinctive scientific results of Peary's Arctic quarter-century must necessarily be general and in somewhat inclusive terms. The monograph which he forecast in his first volume is yet to be published, and through all his work the dominant note is action and advance rather than study and the refinements of research. Every available hour when the difficult leave from the service could be obtained was devoted to detailed plans for the coming expedition; official or organized co-operation with him or discussion of his material was to a degree beyond his command; and the exhaustive analysis and generous publication of results with which foreign governments, notably France, reward their explorers are yet to come.



ROBERT E. PEARY

Born at Cresson, Pa., May 6, 1856; died at
Washington, D. C., February 20, 1920.

Geographical Results

Geography naturally holds first place in an estimate of Peary's Arctic work, and, in this field, statement and appraisal are not difficult. Recall the maps and conditions of 1891, and the conclusions are convincing and immediate. Kane, Hayes, Hall, Greely, Nares, Markham in the western, and De Long in the eastern hemisphere—each had done his best, even to the supreme sacrifice, and yet had left a continuous record of defeat and disappointment, with the solution of the mystery as distant as ever. The charts ran off indefinitely above 83° or 84° N., and the dotted line which represented the limit of human knowledge had a complete radius of about 500 miles in every direction from the Pole. When Peary left Cape Columbia, February 22, 1906, the entire map of the Polar zone had been recast, and, whether he was to reach the Pole three years later or not, he had completely revolutionized our knowledge of the Arctic. Four traverses of the great Greenland ice cap, 2,500 miles of arduous sledging, had placed the flag of his country where it was nearest Europe in a cairn which he recognized eight years later; Greenland was rounded in 1900; the name of Morris K. Jesup was placed on the most northern land (83°29′) in the world; and the Greenland route was definitely eliminated as a route of Polar advance. In 1906 the coast west from Cape Columbia to Sverdrup's farthest was definitely charted, Cape Thomas Hubbard was located and named, and the illusory Crocker Land was given its brief mythical existence. In view of the disappointing result of the MacMillan Crocker Land expedition eight years later, and as illustrating the exactness and accuracy of Peary's methods, it may be worth while to say that he once declared, in discussing a distant prospect, "I'll never say it's land until I have set my foot on it"; and those who can read his exact words will find that his reports of what he believed was land on that June 24 were made with clear and distinct reservations. It should, too, always be borne in mind that not only was Peary by nature and training fully equipped for discovery but that he fully appreciated the value of accuracy. Experience in determining positions and courses as a navigator on sea and as an engineer and surveyor on land, in measuring distances by comparison and average of estimates and by a mechanical odometer of his own invention, enabled Peary to construct charts and maps that have completely revised and superseded the former coast outlines and cape and island positions of Inglefield Gulf, of both sides of Smith Sound, of Ellesmere Island, and indeed of nearly the whole of the great Arctic sector between the eastern coast of Greenland and the 80th meridian west.

Ethnological Results

Next to his work in geography, Peary's contributions to ethnology doubtless have place. Like Columbus he discovered a race; unlike Columbus he made his "finds" his friends, followers, and comrades. Penn with the Indians on the Schuylkill was no more the guide, philosopher, and

friend than was Peary among the little tribe of Arctic Highlanders. To them he brought appreciation, comradeship, and understanding which, strengthened and tested for more than twenty years, "carried on" to the Pole itself. It was Ooqueah, the Eskimo lad whom Peary first saw as a babe in his mother's hood, who proudly bore the American naval ensign in the historic moment when the Stars and Stripes were "nailed to the North Pole." Animated by keen and genuine human sympathy, Peary from his first contact with old Ikwah in 1891 entered into the daily life and experiences of his dusky comrades, shared their joys and sorrows, supplied them with the things which fitted their actual needs, and mingled kindness and sternness with equal justice, so that not only was his word law but all the tribe's resources in worldly goods and man power were always at his disposal. Peary's word with the Eskimos was always his bond, and always the faithful and deserving were rewarded far beyond the letter of the obligation. Many a time boat crews would go ashore and come back empty-handed from the villagers; the natives had nothing or were willing to sell nothing. Whenever Peary went ashore the boat would return laden; furs, dogs, anything the camp possessed were willingly yielded up not only because the immediate return was generous and satisfactory but because Peary wanted the supplies for use in his work and because nothing was too good for him.

This intimate and practical alliance, though Peary developed the scientific lines, opened up what had hitherto been a closed book. The tribe's history and migrations; what they knew of their origin—Asiatic, eastern, western; all that folklore had to tell of customs, social and domestic; a vocabulary of the Innuit language; numerous physical tests and measurements; and a family register of every man, woman, and child from Peary's first landing in McCormick Bay in 1891 to his last farewell almost on the same spot eighteen years later—all these things became available. In these present days of making over the nations of the world it is encouraging and instructive to find one which has neither laws nor literature, neither money nor religion according to civilized standards, and yet holds the even tenor of its happy way in the consciousness that it needs none of them. When the next problem of dealing with subject or inferior races shall engage the world's attention, the record of Peary's dealing with the northernmost, smallest, and least-known colony of humanity will be found full of suggestion and practical wisdom.

Meteorological and Hydrographical Results

In the fields of meteorology and hydrography Peary's observations and records, as might be expected, take high and definitive rank and, while complete and authoritative discussions are not available, have been of great practical value in the study and explanation of Arctic phenomena.[1] Dur-

[1] See, at the end of this article, the summary of Peary's tidal observations prepared by the U. S. Coast and Geodetic Survey.

ing the first winter J. M. Verhoeff, who never returned, kept the tidal registers off Red Cliff House in McCormick Bay, and two years later similar data with hourly meteorological observations were obtained at Anniversary Lodge. When the *Roosevelt* was ready to depart in 1905 the expedition had a definite status as an adjunct to the U. S. Coast and Geodetic Survey, and its work was prosecuted with the sanction and responsibility of that bureau. At Capes Sheridan, Columbia, and Bryant data were secured which were accepted by competent experts as going far to establish, despite the Crocker Land disappointment, the existence of a large land mass or masses in the yet unknown Arctic area. The possible existence of such land masses is the chief inducement and stimulant for the airplane explorations imminent both from American and oversea bases. For the first time the phenomena of air, of sea temperature, and of tides and currents in this region were accurately measured and recorded and their results added to the sum of exact knowledge.

Geological Results

Peary did not pose as a geologist or botanist. He posed in nothing; but that he had vision and appreciation of the forces and beauties of nature, the following description of Whale Sound is conclusive demonstration.

> Fifty-five miles wide at its mouth, which is divided into two broad channels by a trio of commanding islands, and eighty miles deep, it presents every phase of Arctic scenery, climate, and life—is, in fact, a little Arctic world in itself. Along its shores are to be found low grassy slopes; towering cliffs, massive and solid, carved by the Titan agencies of the savage North into wild forms; wind-swept points where nothing can exist; sheltered nooks where never a violent breath of air penetrates; valleys where luxuriant grass is brightened by myriads of yellow, purple, blue, and white flowers; slopes and plateaus as barren as the surface of a cinder pile; huge glaciers which launch a prolific progeny of bergs into the sea; tiny glaciers which cling tenaciously in the angles of the cliffs; miles and miles of glistening blue, berg-dotted water; and everywhere a few miles back from the shore, the shore of that other silent, eternal, frozen desert sea, the "Great Ice." . . . . . .
>
> Such is this region in summer. In winter it would hardly be recognized. The land is shrouded in snow and shows a ghastly gray in the dim starlight; the sea is white and rigid; no sound is in the bitter air, which is pungent with frost spiculae; light and life have fled; land and sea and sky and air are dark and dead and frozen.[2]

A quarter of a century later Ekblaw, the University of Illinois member of the Crocker Land expedition, and Koch, the geologist of the Rasmussen expedition, renewed and extended the work, so that now, on the base lines established by Peary and clearly outlined in his earlier expeditions before the great adventure and single objective had dwarfed and dominated everything else, the geology of North Greenland is practically established and its formations definitely assigned. In ornithology Peary was on familiar ground. As a lad on the islands and shores of Casco Bay he had collected a complete series of the hawks of that locality, and years afterward dis-

[2] "Northward Over the Great Ice," New York, 1898, Vol. 1, pp. 458 and 476.

played with rekindled youthful pride and enthusiasm to his Eagle Island guests the examples of his skill as a taxidermist. Every variety of the Arctic denizens of the air was known and identified by him, and no treasure of all his expeditions was more highly prized than that of the rare and almost extinct knot. Wherever his wide quest led, it was only second nature for him to find—

> books in the running brooks,
> Sermons in stones, and good in everything.

So, when the auxiliary expeditions of 1894 and 1895 were organizing, what more natural, not to say inevitable, than that two of the most eminent American geologists, Professors Thomas C. Chamberlin and Rollin D. Salisbury of the University of Chicago, should find place on board and welcome on shore for the complete intensive study of the entire coast and of the glaciers, advancing and receding, of every known type surrounding Inglefield Gulf—probably the most highly diversified area of such dimensions in the world for geological survey and explorations. Here could be seen at close quarters, as it were, a world in the making; all the processes of which our habitable zones are the latest familiar result may there be seen in all stages of repose and action; and the observations and deductions of these two collaborators during that Arctic summer have become accepted and recognized authority on many doubtful and difficult points for which adequate data were lacking.

Peary the Man

We, of the present, are too near the man and the fact to assume authority for the final verdict on Peary and his work; but it may be awaited without misgiving. No character and no career lend themselves more readily to analysis, and none need them less than Peary's. Simple, integral, and balanced, the evolution was normal and inevitable, and the development during the twenty-three years of Arctic adventure is an interesting study in psychology. No one should think that chance or accident directed his life work. Athlete, engineer, and navigator, he had an equipment that none in his field before him ever possessed. Upon this broad and substantial foundation he built with each year's added experience a commanding personality which brought to his service all the resources of the Arctic. Eskimos and dogs alike loved and obeyed him; nothing which would serve him but yielded to his demand and his unswerving purpose.

Most interesting, too, in the evolution of the years was the development of the American ideal, of the patriotic impulse, of the consciousness that this self-imposed duty was more than personal ambition or adventure, was a call of country, an exposition of national honor, an acceptance of Nature's challenge. No one acquainted with him could come into his presence and fall under the spell of his reserved, restrained personality—for he was not a man given to many words—without a distinct impression of serious

purpose and of high patriotic resolve. It is in this character of the typical, fearless, unflinching American, first and always, of which the explorer was but a phase of expression, that he takes his place in the memory of those who knew him well and loved him best. To catalogue his achievements or cast up his account with science is unnecessary. He has written of these things in fullness of detail, and what he has written can be read by all. Not less will his example, of which he could not write, and our memories of him be possessions forever.

I drink to that great Inn beyond the grave.
If there be none, the Gods have done us wrong.
Ere long I hope to chant a nobler stave
And in some Mermaid Inn beyond the grave
To quaff the best of Earth that Heaven can save;
Red wine, like blood; deep love of friends, and song.
I drink to that great Inn beyond the grave
And hope to meet my golden lads ere long.
(Alfred Noyes, "Tales of the Mermaid Inn")

Summary of Peary's Tidal Observations

(Prepared for this article by the U. S. Coast and Geodetic Survey)

During his last Arctic expedition in 1908-1909, Peary secured tidal observations at five stations. These observations consisted of continuous hourly readings of the height of the tide, day and night, supplemented by more frequent readings near the times of high and low water. The locations of these stations together with the periods during which the observations were made and the length of record secured are given in the following table.[3]

Table I—Locations and Periods of Peary's Tidal Observations

Station	Latitude North	Longitude West	Period of Observations	Length of record
Cape Sheridan.....	82° 27′	61° 21′	Nov. 12, 1908 to June 30, 1909	231 days
Cape Columbia.....	83° 05′	69° 35′	Nov. 16, 1908 to Dec. 14, 1908	29 "
Cape Bryant.....	82° 21′	55° 30′	Jan. 16, 1909 to Feb. 13, 1909	28 "
Fort Conger.....	81° 44′	64° 45′	June 10, 1909 to June 25, 1909	15 "
Cape Morris Jesup.....	83° 40′	33° 35′	May 13, 1909 to May 23, 1909	10 "

These observations, because of the care, thoroughness, and understanding with which they were made, furnish definitive tidal knowledge for that stretch of the Arctic coast. They prove that the tides along the northern coasts of Grant Land and Greenland differ in many respects from what had formerly been accepted. While there are long stretches of the Arctic coast where more tidal information is urgently desired, Peary's tidal observations leave little to be desired between Cape Morris Jesup and Cape Columbia.

As indicating the care with which the observations were made, mention may be made of the fact that out of a total of more than 300 days of hourly observations, under the trying conditions of Arctic weather, breaks in the continuous records due to all causes total but 36 hours.

[3] The observations themselves (hourly tide heights and time and height of high and low waters) are published in R. A. Harris: Arctic Tides, U. S. Coast and Geodetic Survey, Washington, D. C., 1911, pp. 10-30. —Edit. Note.

The series of observations of 15 days secured by Peary's party at Fort Conger has a further interest in that some twenty-seven years previously another noted American explorer had made tidal observations there. It was between 1881 and 1883 that the party under Lieutenant (now Major General) A. W. Greely secured a long and valuable series of tidal observations at Fort Conger. The remarkably close agreement in the results derived from the two series is brought out in the comparison given below.

TABLE II—COMPARISON OF GREELY'S AND PEARY'S OBSERVATIONS

OBSERVATIONS	HIGH WATER INTERVAL	LOW WATER INTERVAL	MEAN RANGE	TIDAL HOUR
Greely's, 1881-83.....	11 h. 33 m.	5 h. 20 m.	4.3 ft.	3.48
Peary's, 1909.....	11 h. 35 m.	5 h. 15 m.	4.1 ft.	3.51

In a previous expedition Peary had secured tidal observations at Cape Sheridan from November 3 to December 4, 1905. It is interesting to compare the results obtained from this short series with the results from the longer series secured by Peary in 1908-1909 at the same place, since it is indicative of the high quality of his tidal observations.

TABLE III—COMPARISON OF A SHORT AND A LONG SERIES OF OBSERVATIONS BY PEARY AT THE SAME LOCATION

YEAR	LENGTH OF OBSERVATIONS	HIGH WATER INTERVAL	LOW WATER INTERVAL	MEAN RANGE	TIDAL HOUR
1905.....	1 month	10 h. 30 m.	4 h. 09 m.	1.8 ft.	2.23
1908-09.....	7½ months	10 h. 31 m.	4 h. 14 m.	1.8 ft.	2.24

Peary's observations are the most northerly tidal observations ever made and constitute an important addition to our knowledge of the tides of the Arctic Ocean.

THE WORLD'S FOOD RESOURCES

By O. D. VON ENGELN
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The immediate prompting for this article was the publication recently of a book of the same title[1] by Professor J. Russell Smith. These paragraphs do not, however, purport to conform to the usual book review, nor are they intended as a criticism of that volume. Rather it is proposed to suggest some considerations, having a bearing on the problem of the world's present and future food supply, that the writer thinks need to be taken into account before one may accept *in toto* the roseate future that Dr. Smith paints.

"The World's Food Resources," by J. Russell Smith

It should be said at the outset that "The World's Food Resources" is a very valuable contribution to geographic and economic literature. In it are summarized exhaustively all the pertinent facts in regard to the varied materials that are serving, and may serve, to furnish nourishment for the human race, and there are discussed the adequacy and extensibility of such auxiliaries, like the nature and number of beasts of burden, that are a necessary part of the equipment for most food production. The book is very entertainingly written, and its material is organized even better than that on the same subjects in the author's earlier volume on "Industrial and Commercial Geography," from which considerable portions have been abstracted and fitted into the new book. Certain *lacunae* in the former book have been filled in, and as a whole the new work presents a very complete inventory and analysis of the wide field its title indicates.

If any fault is to be found, it is that Dr. Smith has not provided us with nearly as many references as he might have done and that he does not cite in full those that he does give, for example one to the *Manufacturer's Record* on pages 321 and 322. That the author has carefully gone over the voluminous source material on his subject is quite evident. It would have been more helpful if he had culled out for us the best of this and thus spared the reader the necessity of making an arduous search when additional or original information is wanted on a given point.

Present and Future Sufficiency of World's Food Supply

The writer, having now conformed, at least in part, to the requirements of a review, may be permitted to revert to the particular phase of the subject which it is proposed to enlarge upon in this article and to consider it from a different angle. That is the question of how amply and how well

[1] J. Russell Smith: The World's Food Resources. 634 pp.; maps, diagrs., ills. Henry Holt & Co., New York, 1919. $3.50. 8½ x 6 inches.

(in richness and variety) the world can supply food to present and future human populations. Dr. Smith's position, maintained through all his pages, is well indicated by his beginning of Chapter VIII on "Meat, Men, and Land," where he writes: "Perhaps some reader of this book, seeing statements of the great and in some cases almost indefinite possibilities of increase in breadstuffs and bread substitutes, has come to the conclusion that the author is an incorrigible optimist, touched perhaps with unreason." It is not quite so bad as that, but it should be said that Dr. Smith's statements in regard to the indefinite extensibility of the supply of food materials, while entirely warranted by the facts as he presents them, must nevertheless be accepted with a number of reservations, the need for which the incautious reader will not perhaps perceive, because of the presence of positive sentences like "Agricultural overproduction, not famine, is the problem of thousands and thousands of American farmers" (p. 157). On the other hand it is only fair to say that these limiting factors are suggested every here and there through the pages of "The World's Food Resources," but they are never made emphatic, and what is hid in their shadows may easily be overlooked in the genial sunshine which floods by far the major portion of the pages.

Means of Expanding the Food Supply

Expansion of the world's food supply, in order to feed the present human population more adequately or to provide for future greater numbers, may be possible by a number of means. These can be concisely summarized under the following heads:

(1) *Geographical extension of the areas of food production* by:

(a) Occupation of lands adapted to crop or animal production which are as yet inaccessible or only sparsely peopled or inefficiently used, and by swamp drainage and desert land irrigation.

(b) Utilization of lands now too cold or too dry for growth of crops by development of new varieties of food plants that can survive these hard conditions.

(c) Recovering for food production lands now used to grow crops the yields of which are devoted to the arts and industries.

(d) Recourse in greater measure than now to the seas for food.

(2) *Increasing yields per acre* by:

(a) Plant breeding to develop varieties giving higher yields at no greater labor cost.

(b) Substitution of plants giving high return for those now cultivated giving comparatively meager yields.

(c) Dependence on perennial and more certain tree crops instead of so largely on difficultly reared annuals.

(d) Intensifying agriculture by expending more human effort per acre than now.

(3) *New inventions and discoveries,* as:

(a) More complete utilization of crop produced, as by ensilage of corn for cattle feeding or using cottonseed for edible oils.

(b) Utilizing mechanical energy to make possible greater yields per unit of human effort, as by farm tractor.

(c) Improvement of transportation facilities and devices to make all areas available for the crops for which they are best adapted, as by refrigeration to make possible greater supplies of tropical fruits.

(d) Increased volume and quality of fertilizer supply by recourse to new sources, as nitrogen from air through electrical power.

(e) Improved methods of culture and seed selection so that without greater effort higher yields are obtained, as by terrace plowing to conserve rainfall and soil, by spraying fruit, etc.

(f) More general and more efficient storage and better preserving methods so that perishable commodities can be kept for long periods, as by dehydrating vegetables.

(g) Better systems of distribution to prevent the wastes due to so-called overproduction, as by eliminating such procedure as shipping green produce from area of production first to central-market middleman, then back to retail area which is in region of original production.

This is an impressive list of possibilities and a quite reassuring one when the vistas opened up by even a single item from among the various subheads are considered. Just because the prospect is so alluring, however, it is worth while to pause and remember that many of these possibilities have long been open but that mankind has nevertheless in places and at times experienced the pangs of hunger and that, while famines have not oppressed the rich and sparsely populated Western world very severely in the years preceding the world war, starvation has been the fate of millions almost every year elsewhere, for example in India and China. Why should this be so?

The Small Margin of Production Over Consumption

Because, first of all, the margin of food production over food consumption in any one year is very narrow. As measured by excess of exports over imports the wheat crop, which of food materials has the most important place in international trade, shows a surplus in normal years (before the war) of a little over 1 per cent of the total production, only 44,000,000 bushels remaining as a probable carry over from all the 3,823,000,000 bushels grown.[2] Years of high yield of wheat in one area are in general offset by a partial or complete failure in other important producing areas; thus the Argentine crop was practically a failure in 1917 owing to drought, while in the United States there was an exceptionally good crop both in

[2] G. B. Roorbach: The World's Food Supply, *Annals Amer. Acad. of Polit. and Soc. Sci.*, No. 163, Vol. 74, November, 1917, pp. 1-33; reference on p. 9.

1914 and 1915. Even if there should be a succession of good years in all important growing areas, no provision exists for carrying over the surplus into the lean years that must follow. Any large excess of production of so staple a commodity as wheat simply brings about an automatic reduction in the price over that period, with the result that some of the normally underfed groups of the world's population are able to satisfy their cravings more fully. Ancient Egypt prospered for thousands of years with plenty of food always, it seems, for even the humblest slave, apparently because of the collection of taxes *in kind* and their storing in the national granaries against the deficiencies of succeeding years when the life-giving Nile flood might not rise to its average level. The story of Joseph is the record of how greatly this political economy of the agricultural Egyptians impressed the shepherd nomads, who could make no such provision for lean years.

Prevalent Dependence on Home Production

Wheat is exceptional in that it enters so largely into international trade. Most of the food produced in the world is consumed at home and very largely in the immediate district where it is grown. In bushels, potatoes, in food value, rice much exceed the total production of wheat, but both serve almost exclusively only to feed the peoples who grow them. Corn, another great food, likewise plays little part in feeding alien nationalities, except that in times past, and again recently, much of the large United States crop goes abroad in the form of the elaborated product, pork. Meat from foreign shores, if dairy products be excepted, is of little significance in the rationing of nations. All the variety and vast bulk of perishable foods move only short distances from their sources. The ancient success of Egypt was due to the fact that in the simple life of the time it was a self-sufficing country; food was practically the only need of its population, and food the irrigated Nile Valley and delta produced plenteously. Geographers now write much of the increasing separation of the home and work space on the one hand and the sustenance space on the other. As a matter of fact they are still quite close together, so far as the bulk of the world's population is concerned.

Countries Dependent on Imported Food

Here it may be objected that, while it is true that a very high percentage of the peoples of the world are still dependent for existence almost exclusively on their home production of food (80 per cent of the working population of India is engaged in agricultural pursuits), it is also true that under modern conditions other prosperous and large groups get a large proportion of their food from abroad. Thus Great Britain before the world war imported 47 per cent of the food requirements of its 45,000,000 inhabitants, and Belgium 43 per cent of the needs of its 7,500,000. These are, however, exceptional instances; the other important food-importing

countries, Italy, Germany, France, and Austria-Hungary, did not attain nearly so high percentages of food imports to total food needs.

But Great Britain and Belgium did succeed in supporting their populations largely on imported foods, and this fact immediately leads to the conclusion that such practice may be much extended. It is argued that the expansion of all Western Europe in population and prosperity has been due to the utilization of the vast new lands of North America and elsewhere for the production of a flood of new food. But this ignores the true inwardness of the situation. It was not the knowledge of these virgin lands nor even their occupation that made cheap imported foods possible. Rather it was the fact that between the years 1870 and 1890 the transportation of bulky products was revolutionized. Had it not been for that development the production of surplus foods in outlying regions would not have occurred, as indeed it was not large before 1870, though a large part of these lands were then available. Between 1870 and 1890 railroads multiplied, steamship capacity was doubled and quadrupled, speed of service was increased, charges much decreased. In 1869 it cost approximately 37 cents to transport a bushel of wheat from Chicago to Liverpool, in 1905 only about 10 cents.[3] Even so, the change to dependence on imported wheat was in Great Britain brought about in part fortuitously, for between 1853 and 1873 agriculture was prosperous in the English lands, only 10 per cent of the people being fed with imported wheat, while 1876 and 1877 were bad years in English crop production, and this fact, coupled with the expansion of transportation facilities up to the present, is responsible for 90 per cent of Great Britain's wheat consumption being supplied after 1906 from other lands.

Transportation Costs As a Hindrance to the Extension of Food-Producing Areas

The same factor of transportation cost is now as much effective as ever. As Dr. Smith himself points out,[4] London is the price-setting market for wheat, and eastern Idaho is a traffic divide for wheat moving east or west to that market. In eastern Idaho the producer, accordingly, receives of all growers the lowest price for his wheat (if an export surplus is grown in his district[5])—in a given year 30 cents less than the price at Chicago. In Persia a distance of 300 miles makes the difference between $1.00 and $10.00 as the price of 650 pounds of wheat, and the excess supply of the rich oasis rots because the transportation cost over this 300 miles is even greater than the price difference.

Apply this principle next, then, to the vast marginal lands in Canada

[3] F. A. Ogg: Economic Development of Modern Europe, New York, 1917, pp. 162-165.

[4] J. Russell Smith: *op. cit.*, pp. 33-34, and L. B. Zapoleon: Geography of Wheat Prices: Summary of Conditions Affecting Farm Prices of Wheat in Different Parts of the United States. *U. S. Dept. of Agric. Bull. No. 594*, Washington, D. C., 1918.

[5] C. S. Scofield: The Geographical Factor in Agricultural Industries, *Geogr. Rev.*, Vol. 1, 1916, pp. 48-49.

and Siberia that are adapted to wheat production. Every additional mile that wheat growing is extended beyond the present limits (with existing *routes*, not *lines* of transportation) means that the London price must be a fraction higher if the grower in those remote regions is to find his occupation profitable with equality of sacrifice. Moreover, any rise in price means that in the nearer wheat lands some intensification of agriculture will pay, that is more human effort can be expended in cultivation of the crop with expectation of a higher yield. The law of diminishing returns of course puts a limitation on the possibilities of profitable intensifying, but considerable increases in yield can be attained without too much expenditure of effort in the older lands; hence this fact, together with the increased cost of transportation, makes the occupation of the outlying lands a slow process and one that only comes about as an accompaniment of distinctly higher prices, that is an increasing handicap on the import of food by peoples whose production is deficient.

The Dilemma of Increased Supply or Lower Standards of Living

Dr. Smith recognizes this situation, too, but argues (pp. 413 and 412-413): "We may have to choose some day between more and more mechanical goods and more food." "The most conspicuous feature of the conditions of living in America, and to a large extent also in England, France, and Germany during the last twenty-five years, has been the rising standard of living— . . . . . five million automobiles [owned] by the people of the United States . . . . . , millions of phonographs in the homes alike of workmen and millionaires . . . . . , without any appreciable reduction in the sale of any other kind of goods, save carriages." Again (p. 239): "No discussion of unused meat resources should cause us for a moment to forget the fact that there is no prospect of permanent relief in sight. . . . . That small minority in the Western World who have so nearly monopolized the world's meat will have to reduce their consumption."

In other words, increase in the world's food supply is indefinitely extensible at the cost of reduced standard of living, sacrifice of comfort—until perchance all the world's population sinks to the level of India's hordes. Pleasant prospect. On the contrary, increase in the world's food supply means nothing unless we can keep all we have of mechanical appliances and increase their number, automobiles, phonographs, bathtubs, "movies," clothes, etc. It is pointed out that Canada has for years offered 160 acres of rich level prairie land, adapted to wheat raising, for the taking; but also that this land is twenty to thirty miles back from the railroad, is bleak, windy, and often quite treeless. It might be added that it is fearfully cold in winter, that fuel is difficult to get, that house-construction material is very expensive, that there is no social life. How eager is the reader to quit his present work to go out to this rich prairie and add to the world's food supply? Similarly if we need to give up meat and wheat

and resort to the equally nutritious but less palatable rye, barley, maize, millet, soy beans, acorns, and coconut butter, our joy of life declines so much. It may be that we are capricious and conservative in our choice of foods, but the fact remains that the Russian peasant prefers wheat bread to rye bread when he can afford it; and the circumstance that Kaiser Wilhelm "used occasionally to trade the white bread of the palace kitchens for the black rye bread of a peasant boy," as Dr. Smith tells us (p. 74), may have been one of the Kaiser's few endearing acts, but it is also another example of his preferences that we do not care to adopt as a matter of necessity. (Incidentally, it is extremely curious how this idea, that the whims of royalty are an adducible argument in favor of the acceptance of any given notion, persists, even when such a personage as Wilhelm must be cited. One could understand a professor's pointing out that another learned man preferred rye bread to wheat bread, but this other idea is evidently a mental survival from the Middle Ages.)

There are, of course, commodities that the world can well dispense with and thus have more energies available for the production of food—alcoholic liquors, for example. It is a rather curious fact that, in the voluminous newspaper and magazine discussions on the subject of extravagant spending and prohibition in the United States, so little appears about the effect of diverting the millions formerly spent for drink to the purchase of other commodities, not to mention the conservation of all the grains and other agricultural products that were needed to produce such beverages. In this there has been a real expansion of the food supply, coincident with increased purchasing power for other comforts.

"Human Nature" As an Obstacle to Extending Food-Producing Areas

A mere searching out of the geographic possibilities of extension of food resources that does not take into true account varied human traits is apt to lead to very unsafe deductions. Argentina has fine wheat lands, so located with reference to transportation lines and the London market that their product could be very profitably sold at prices prevailing before the war. But vast tracts of this land are in the possession of a few owners, who derive incomes entirely adequate to their luxurious tastes by using the lands for sheep pasturage only; and this disposition of their acres leaves the owners much more free to pursue lives of pleasure than when they are bound down by the exacting superintendence necessary to make a success of wheat growing. Again, quoting Dr. Smith once more (p. 524): "It is generally expected that thousands of soldiers, for years freed from the restrictions of city life, will insist upon the freedom of out-of-doors." Quite the contrary, however, proves to be the case, as might indeed have been surmised if the prophets themselves had had the experience with the out-of-doors which the soldiers had. A little out-of-doors, a camping holiday, is a lark to the city dweller, but the doing without all the customary

comforts and conveniences, warm baths, clean clothes, theaters, stores, and books, for indefinite periods of time arouses rather, in the urban born and bred, a fierce longing to be once more and for always provided with city surroundings. And if the soldier did have ideas of developing government land, it is more than likely that his city-bred girl would look askance at the idea of becoming a pioneer's wife. Hence the notion that the Mississippi River swamps will be reclaimed and made food-producing by the returned soldier must be dismissed as an idle dream. Even where conditions for going on the land are most favorable, as on the government irrigation projects, it is said to be difficult to get settlers, because these lands do not give any promise of a speculative profit—they offer a livelihood but not the opportunity to sell out shortly at a large increase to some other fellow. Something of the same nature will prevent the wider utilization of tree crops. While the return from tree crops may be handsome, after a number of years, the wait often occupies so large a part of a man's lifetime that few have the faith and patience, to say nothing of the necessary capital, to plant such a crop. And success is by no means assured: a grove of chestnut trees may succumb to the blight, of oranges to a frost, of coconuts to a hurricane or to bud rot.

Population Increase

What has already been suggested will suffice to indicate that the world's food supply cannot be expanded indefinitely as easily as one slips on an old shoe. On the other hand the numbers of people who need to be fed do seem to expand with something like that kind of facility. Since 1800 the world's population has increased from 640,000,000 to 1,693,000,000, or nearly tripled in a century and a fifth. Moreover, the greater part of this expansion has taken place in those countries which have been affected by modern Western civilization.[6] Europe, which in 1741 had an estimated population of 127,000,000, in 1914 was occupied by 452,000,000. Under British rule, accompanied by introduction of the devices and discoveries of the Western world, the population of India increased in 39 years from 186,000,000 in 1872 to 244,000,000 in 1911, or by some 58,000,000 souls. In Japan the population increased from, in round numbers, 33,000,000 in 1871 to 54,000,000 in 1914. Of two periods, "each of 43 years, one just before and the other just after the opening of Japan to influences from Europe," "in the later period population increased three times as fast as in the earlier."[7] In North America, in Australia, New Zealand, South Africa, Egypt, Argentina, Java, and the Philippine Islands, the same sort of tremendous expansion of population has taken place, a phenomenon probably without precedent in history, the possible exception being ancient Egypt.

[6] W. F. Willcox: The Expansion of Europe in Population, *Amer. Econ. Rev.*, Vol. 5, 1915, pp. 737-752.
[7] Willcox, *op. cit.*, p. 750.

On the other hand, according to the best evidence available, there has been but little if any increase in the population of China between 1850 and the present time. In the heart of Africa it is estimated that there has been a reduction in population in 32 years of 70,000,000 people—from 206,000,000 in 1882, to 136,000,000 in 1914. Meanwhile, however, the comparatively few thousands of negroes carried to the Americas as slaves had increased so that they numbered 13,000,000 in 1915.

The Close Relation of Population Growth to Food Supply

What is the significance of these facts in regard to population growth or decrease with reference to the food supply? Essentially it is a verification of the Malthusian doctrine that populations tend to increase as fast as the food supply. This can be otherwise put by saying that the increase in numbers that normally accompanies the availability of more food prevents any improvement in the standard of living. Thus the British and the Dutch, by introducing new methods for increasing the efficiency of agricultural labor and extending its scope in India, Egypt, and Java, without at the same time changing the cultural status of the coolies and the *fellahîn*, have not, so far as these natives are concerned, materially improved the food situation. Accompanying the increase in income from their lands has come such an expansion of population that they are as near famine and starvation as ever. In Japan, similarly, no appreciable improvement in the standard of living of the mass of the people appears to have accompanied the increase in population, though the productivity of the country as a whole has been increased by the absorption of the energies of these greater numbers in the development of machine manufactures and shipping. It is said that before the world war Japan was reclaiming each year an area sufficient to feed 200,000 people and that new lands, available to be reclaimed, will provide for 30,000,000 more at the present standard of living; but this prospect loses all its impressiveness when it is offset by the fact that in the last 43 years the population of Japan has increased at the rate of about 500,000 people per year. It is true that a comparatively few Japanese, Indians, Dutch, and British have become enriched in the process of expansion and improvement of methods; but no larger surplus of food has resulted, nor has there been any more food per coolie available in those countries than there was before.

Effect of the War

It does not suffice to assert that population does not increase in geometrical ratio over large areas for long periods of time and that there is therefore no danger of a food shortage, for very evidently the figures indicate that population has been increasing with extraordinary rapidity for considerable periods and over all the areas in which we are most interested. The effect of the war on food supply furnishes a confirmation of

the conclusions that such facts suggest. Sources of food normally available to the Western world were then shut off, because of lack of shipping and the war blockade and because millions of men were diverted from crop production to war work. In effect both these changes were the equivalent of a great increase in population. Was there immediately available an enlarged food supply to meet the new need? War rationing and the present plight of much of Europe and the rate of exchange even for English pounds is the sufficient answer. Despite the stimulus of higher prices and the adoption of many expedients that made possible an actual net gain in food supplies and a lower standard of living even in America for the war years, there is a shortage. Recovery seems possible only by condemning the European peoples, particularly, to a still lower standard of living than prevailed before the war. The same trend is indicated in America by the reiterated editorials against extravagance which are to be interpreted simply as admonitions to reduce the standard of living and expend more energies (increase production) that food supplies and capital accumulation for the further extension of food-producing areas (by increasing transportation facilities, for example) may be made available. More food, yes, at the cost of the expenditure of a greater proportion of the total sum of human energy to meet the needs of an increasing population.

Reasons for Non-Increase of Population of China and Interior Africa

Why has the population of China remained stationary and that of interior Africa actually decreased during practically the same period in which these tremendous increases in population were occurring elsewhere? Not because births were any less numerous in China or Africa, but because the deaths equaled or exceeded the number born. The causes of those deaths are illuminating. In China famine, flood, pestilence, and civil war devoured the natural increase of normal years. In 1849 some 14,000,000 Chinese perished of hunger. And it may be concluded that if pestilence, disaster, and civil war (itself probably the result of hunger) did not clear off the surplus population so often there would be more famines to bring about the same results. In Central Africa the same conditions apply, plus the effects of the overland slave trade. Here Western civilization secures the products it wishes from the country without introducing any devices to increase food supply, and as this means that the energies of a certain proportion of the natives (while they continue to live and require food) are diverted to other tasks, the efforts of the rest, using the old methods, will not suffice, and some must perish.

Greater Efficiency in Production the Chief Hope for the Future

The prospect so far presented seems altogether dismal and in entire contrast with Dr. Smith's optimistic anticipations. But the future is not altogether dark. The possibilities that promise an increase in food supplies,

without a corresponding increase in human effort, have been ignored (except by inference) in the preceding paragraphs and must now be taken into account.

The fact is that a popular misconception of what are the really significant possibilities for obtaining an enlarged food supply has prevented a rational understanding of the subject. Writers, generally, have so much emphasized the future importance of the geographically unused land areas of the world, particularly the tropics, that the public has been fascinated by this lure to such an extent as to ignore other factors that will more certainly fulfill expectations. The chief hope for the future lies in the promise of greater efficiency in production by the human race itself. Every device and every discovery that leads to enlarged food production without also entailing more human labor may be counted as contributing to a net gain in the world's well-being, provided that such increase in food is not absorbed by an increase in population of equal consuming capacity. Even if the total quantity of food now produced, relative to population numbers, is not increased, if only a proportionately lesser number of workers are able to produce as much food as is now available per person, there will be a gain, for the toilers who are thus released can devote their efforts to the production of other commodities for our comfort. Contrariwise, if some new invention in mechanical processing of materials makes possible the same output with a less number of operatives, then we have so many more individuals available for the intensification of agriculture—similarly a net gain. It is said that an increased wage paid an Indian coolie ordinarily results merely in his being willing to work only five days in the week where before he worked six, even though his hunger is not fully appeased. The sacrifice of toil is to him greater than the internal pangs due to insufficient nourishment. It has been found that this aversion to toil is largely due to the effects of the hookworm disease; hence eradication of that ailment in India, as in the American South, will make the coolie, like the negro, more productive without subjecting him to greater physical wear than he now endures.

It has been suggested in an earlier paragraph that the extension of wheat growing farther into northwestern Canada under existing conditions would afford no relief because such an extension could only be made possible by a rise in price. Additional railway lines would not help *unless* they shortened the distance over which transportation was necessary. Hence, also, when the railway line from these areas to Hudson Bay is completed, an immediate great gain will have been achieved, for then this region will have a shorter outlet to the seaboard, with the attendant cheap transportation of ocean carriage, and its wheat crop can enter the London market at a profit at the present price level. Again, if some mineral product of high value and small bulk should be found in the Canadian region, and farmers adjacent could grow the food necessary to support the mining population,

the problem of utilization of these areas would be solved. This is the function of vegetable and meat production (cattle, reindeer, yak) in northern and interior Alaska in connection with gold mining there. If any person is dazzled, however, by the apparent possibilities of unlimited extension of agriculture into distant undeveloped lands he should read, for an appreciation of the true economic situation, Scofield's account[8] of the problems of the farmer in a remote irrigation area.

Value of Machine Processes

Machine seeding and harvesting and the roller process in flour making, combined with the development of railroad and ocean navigation, provided Europe with bread made from hard spring wheat. The recent application of machinery to rice growing in Texas and Louisiana promises to bring about a similar reduction in the cost of growing that grain. Even now, with high-priced labor, it is possible to produce rice there at a lower cost than can the cheap coolie by his garden cultivation. In actuality the agriculture of China, particularly, is wasteful and inefficient in many respects, and we may see the day when machines will produce more rice with less labor in China than its struggling millions have ever made the earth bring forth. Our old farms and the old crops are having their labor costs reduced by the farm tractor; its use will make profitable the development of lands climatically uncertain, as one or two crop failures in five will not spell the disaster that would ensue with horse cultivation; similarly the tractor will permit the fallowing of land for alternate year cropping. The centrifugal separator and mechanical milkers have in like manner reduced dairying costs.

Scientific Agriculture

Varieties of wheat requiring a shorter season to mature or made drought-resisting by plant breeding, of potatoes and sugar beets bred to give higher yields, selection of peaches with green bark to prevent too early budding and frost injury, larger yields from the same fields by introduction of alfalfa hay, the soy bean, and the peanut—all make for true gains in the total food supply. Fertilizers from new sources, nitrogen from the air, and coke-oven by-products, phosphorus from the blast-furnace refuse will also enable the same acres and the same labor to produce additional food.

More scientific practice of agriculture, generally, can do much to enlarge the food supply. By terrace plowing, water pockets, and use of explosives moisture may be conserved and soil erosion prevented. In Hawaii the rows of sugar cane are covered with paper which the young shoots of the cane can penetrate but which prevents the growth of weeds. Ensilage permits the use of all the corn plant; animal industry carried on in connection with ensilage feeding enriches the farm with manure; crop rotation of the proper kind keeps farm labor busy at all seasons; the hog can be used

[8] Scofield, *op. cit.*

to harvest peanuts, goats to crop steep hillsides, sheep can be made profitable by eliminating the useless dog. In Brazil the Indian zebu[9] has been introduced because it has been found that such hybrids are immune to tropical cattle diseases (particularly Texas fever) and give fine meat; in Germany the same hybrid is found to be resistant to tuberculosis. Cattle raising in all the warm parts of the world where pasturage is abundant the year round is thus made possible. In Africa a cross with the zebra is providing a similarly immune work animal. As it has been established that salmon return to the stream in which they were born it will be profitable for privately owned canneries to conduct hatcheries and assure themselves of a perennial run of fish.

Tree crops also promise much. Spraying assures saving the yield of many fruit orchards; it has been found that orchards on slopes escape frost damage. With proper mulching it may be possible to grow olives on the American Great Plains. Indigo chemically produced has freed lands for food crops, as may also synthetic rubber. The cotton seed and the palm kernel are no longer wasted, the coconut by chemical treatment yields a substitute for butter fat, maize now supplies us with corn oil and corn syrup.

Better Food Conservation and Distribution

Modern dehydration, without destroying flavor, enables us to conserve the seasonal oversupply of perishable vegetables without recourse to expensive canning, particularly the difficultly stored sweet potato and the watery tomato. If, in addition, we can bring ourselves to accept so much of socialistic doctrine as to provide for public purchase of conservable crop surpluses in any one region and store them in government-owned warehouses, we can at once insure the grower and stabilize prices. Dried milk is already on the market. Improvement in refrigeration may make available such tropical fruits as the dasheen, the plantain, the avocado, and the mango, as well as the banana.

Better transportation and distribution will permit wider use of materials that now often go to waste. A barge load of apples from the northern New York region tied up at the East Side in New York City would find a ready sale. Motor trucks permit outlying farmers to grow green vegetables for city consumption. The dispersal of industry to suburban districts will make chicken raising and bee keeping possible for the workman. An acquaintance got 600 pounds of honey from hives in his back lot during the season of the sugar shortage.

Most of these items Dr. Smith suggests, as well as others of similar nature that his wider knowledge permits and which have been missed here. Every one of them opens, or has opened, the possibility of a larger food supply at no increase in human effort. Taken together they afford promise

[9] See *Bull. Pan Amer. Union*, Vol. 40, 1915, pp. 674-679, quoting B. H. Hunnicut and José Maria Dos Ries from *Journ. of Heredity*, May, 1915.

of enough to eat in the immediate future. But their general nature will sufficiently indicate that time is needed to bring them into play. We are not threatened by any avalanche of new food in the next few years. Will population growth in the meanwhile outstrip inventive genius for providing food increases? Perhaps the best preventive for that will be a world insistence on a higher standard of living in all countries, as the surest method of checking the poverty swarming that now obtains in some areas.

Certain Recent Discussions of the Food Problem

The argument thus far has been general rather than specific. Therefore it seems due the reader who has been sufficiently interested in the subject to pursue it to this point that recent detailed discussions of various phases of the general problem be brought to his attention, as indicative of the sources from which information and opinion on the several factors involved may be gained.

The "Geography of the World's Agriculture," recently reviewed in these pages,[10] contains, in addition to its many valuable maps and accompanying discussions of the distribution and production of the world's food crops, on pages 148-149 a bibliography of the more important statistical sources on agricultural production in all parts of the world.

International Apportionment Suggested by War Conditions

Reference has already been made to an article by G. B. Roorbach in the *Annals of the American Academy of Political and Social Science*. All the November, 1917, number of this publication is devoted to the general subject of "The World's Food." The contents comprise about three dozen different articles, each by a different author, grouped under four heads: "The World's Food," "Food Utilization and Conservation," "Production and Marketing Plans for Next Year," "Price Control." The article by Roorbach bears most directly on the general topic of the present paper and contains much interesting matter in the way of comparative statements of food production and consumption in the different countries. Roorbach's main contention is that in any one year the margin of food production over food consumption is very narrow. Written at the crisis of the war, it is only natural that the chief emphasis of all the papers should be on the immediate problem of war needs. Nevertheless, B. S. Butler, in a contribution on "International Rationing" predicts (p. 40) that the after-the-war period will see the adoption of some scheme by which all raw materials, including food, will be internationally apportioned. Thus Italy, for example, will engage to sell the United States a certain bulk of olive oil only on the basis of receiving from us a fair exchange value in raw materials of our production which Italy lacks. The present tendency,

[10] V. C. Finch and O. E. Baker: Geography of the World's Agriculture. Office of Farm Management, U. S. Dept of Agric., Washington, D. C., 1917. Reviewed in the *Geogr. Rev.*, January, 1920, pp. 74-76.

because of the collapse of international exchange, to international barter of commodities, is, in this connection, suggestive.

Representatives of the neutral nationalities each present the plight of their country in respect of food, and, while we may, without malice, assume that they made their several needs appear as urgent as possible, there was probably no downright overstatement. Fridtjof Nansen points out (p. 44) that, despite the fact that in many years emigration from Norway was greater than one half the increase in population by birth and in some years equal to the total of such increase, that country's increase in population during the last century had nevertheless been the greatest in all Europe and was in the ratio of 100 to 254; also that agriculture was still the main resource of Norway and that, while its practice had been much intensified, the returns had not kept pace with population growth. Hence Norway needed now to import 58 per cent of her grain requirements, 33⅓ per cent of her fats, and all her sugar. A. R. Nordvall (pp. 57-58) stated that, while, between 1820 and 1830, 82 per cent of all the Swedes were agricultural workers and in 1910 only 48 per cent, Sweden was nevertheless producing greater crops now; but that in spite of this, whereas formerly there was an export surplus, now about one-fourth of their food requirement was imported.

For the Allies the food situation of Japan (pp. 81-82) was indicated by Viscount K. Ishii as not serious, but only because of Japanese frugality as compared with the "magnificent luxury" of America, as Japanese food requirements were limited to the barest necessities of life and the nation's diet consisted mainly of vegetables, rice, roots, and barley. François Monod reported for France (p. 84) that French wheat production before the war barely equaled home consumption, Arthur Pollen for Great Britain (p. 91) that by weight one-fourth of all British food was imported.

Essential Elements in Food

In the section entitled "Food Utilization and Conservation" is a very suggestive article by E. V. McCollum entitled "Some Essentials to a Safe Diet" (pp. 95-102), emphasizing the significance of the two unknowns in food substances, generally referred to as vitamines. The author points out that while cereals are the cheapest energy foods, all seeds are deficient in one of these two food essentials. This, the "A" vitamine, is, however, plentiful in milk, in eggs, and in plant leaves. The "B" vitamine is absent from polished rice, from both vegetable and animal fats, from sugars and starches. Lack of the first vitamine produces eye trouble in children; deficiency in the second, beri-beri disease, the characteristic of which is general paralysis.

Here is introduced a factor of the food problem that has only been touched upon in the preceding paragraphs. The obstinate refusal of the North European peasantry to adopt our high-yield corn as a chief food

staple has been much commented on. But it appears that there is a good reason behind this instinctive aversion. The maize kernel is found, by actual experimentation with human beings, deficient in three ways as human food. Its proteids are not of satisfactory character, it lacks a sufficient amount of "A" vitamines, and it is too poor in inorganic salts. While this indictment in a general way applies to all cereals, corn alone, in particular, will not support physiological well-being in a growing animal. Moreover, it appears that their customary unvaried corn bread, salt pork, molasses diet is responsible for the fact that thousands of the working people of the American South at the end of winter suffer from pellagra, as do also the Italians, who subsist largely on polenta. If milk is used, meat can be dispensed with, hence vegetarianism is entirely feasible. But the cost of milk must go up and up as far as is necessary to preserve the dairy industry, and an adequate supply of green vegetables must be made available to the city dweller. Green vegetables because of spoilage are hazardous stock for the retailer; hence the exorbitant prices usually charged. The alternative is a resort to a bread made up of cereal with an admixture of alfalfa-leaf flour. To be sure, such a bread would be slightly green in tint and astringent in taste, but small matter that to the food enthusiasts who urge blithely that if we will only overcome our silly prejudices there is food in plenty.

The Problem of Marketing

A. B. Ross, under the title "The Point of Origin Plan for Marketing" (pp. 206-210), proposes a solution for this problem of green foods by the establishment of standardizing plants located at the strategic geographical points between a given producing region and its city market. He suggests that all raw produce from the farm shall pass through such plants and, under direction of an expert, be graded, prepared for the retail market, and placed in cold storage or canned whenever there is an oversupply of perishables at a particular time. Retailers' and consumers' co-operatives generally could depend on such a regional institution for all requirements of the local market, and this would do away with the erratic and expensive transshipment now characteristic of the distribution of many perishable foods.

Herbert Hoover[11] likewise maintains that agricultural industry must be made to pay adequate returns to the farmer and concurs in the finding that the excessively high cost of foods to city customers results from faulty transportation and the altogether disproportionate spread in price between the wholesaler and consumer. Like Ross, he finds this to be due in part to the wide distances, often, between the producing areas and their markets, which could usually be remedied; and the fact that each of the

[11] H. C. Hoover: Some Notes on Agricultural Readjustment and the High Cost of Living. *Saturday Evening Post*, Vol. 192, 1920, April 10, pp. 3-4, 45, 46, 49, 50.

intermediaries concerned in this faulty distribution system, wholesaler, transportation agent, commission man, cold-storage warehouser, food manufacturer, retailer, must make a separate profit on his investment; and, as each one of them conducts his business on a percentage basis, every increase in the original payment to the farmer is many times enlarged before the commodity gets to the consumer.

Release of Land by National Prohibition

Reverting to the *Annals* articles there is one more paper of interest, that of A. C. Bigelow (pp. 191-197), "The Sheep Industry of the United States," in which it is stated that between 1900 and 1910 the acreage of land under cultivation in the United States showed a per capita decrease of 10 per cent and that production, by commodities, of butter, oats, wheat, and corn, decreased 10, 11, 15, and 21 per cent respectively per capita. On the other hand R. E. Smith[12] estimates that 3,600,000 acres devoted to corn, barley, and rye for liquor production have been released for food growing by national prohibition and that, altogether, prohibition has directly and indirectly freed some 5,000,000 acres, enough to feed 4,000,000 people. Because of high prices during the war years, he further estimates that some 25,000,000 to 35,000,000 more acres of American land, formerly waste and pasture, were brought under cultivation.

Checking Overpopulation

It is quite distressing to proceed indefinitely in a pessimistic strain on this subject, hence the slight relief suggested by this recovery of land for food through prohibition is pleasing. And the situation is not altogether hopeless. But all the remedies proposed approach the problem from the wrong side. While it is altogether laudable to urge all possible means for increasing the food supply and procuring its better distribution, it ought to be made a first object of the nations of the world to "succeed with what they have" instead of desiring to expand indefinitely in numbers regardless of the present world provision for subsistence. In other words it should be much easier to curb overpopulation than to provide new avalanches of food.

Readers of this *Review* will therefore find of equal interest an article by J. O. P. Bland[13] in which five books and papers of great geographic significance are reviewed, inasmuch as the contributions that Bland ana-

[12] R. E. Smith: Thirty Million More Acres, *Independent*, Vol. 97, 1919, pp. 292-293.

[13] J. O. P. Bland: Population and Food Supply, *Edinburgh Rev.*, Vol. 227, 1918, pp. 232-252. The five publications reviewed are:

James Marchant: Birth-Rate and Empire, London, 1917.

The Declining Birth-Rate: Report of the National Birth-Rate Commission [of Great Britain], London, 1916.

C. K. Millard: Population and Birth Control: An Address. Leicester, 1917.

Adelyne More: Fecundity Versus Civilisation. London, 1917.

William Bateson: Biological Fact and the Structure of Society (Herbert Spencer Lecture, 1912). Oxford, 1912.

lyzes all emphasize the effect of the factor of population growth. In what follows the figures for birth and death rates and other vital statistics are, unless otherwise indicated, taken from this article.

Bland points out that the various panaceas that have been proposed for the amelioration of human woes recognize that the first essentials in such a program are the reduction of poverty and the elevation of standards of living among manual workers, but that, contrariwise, the proposers of such panaceas usually refuse to recognize that the fundamental cause of economic pressure is overpopulation. Any proposal for the limitation of numbers in a given national group seems to be instinctively resented and to provoke a feeling akin to race hatred. Hence, Bland says, positive checks—war, pestilence, famine—must operate. The fecundity of the human race has become adapted to these positive checks. In the Middle Ages the European birth rate was 45 per thousand, and the death rate the same; during the last century the birth rate has not been greatly reduced, but the death rate is only 14 per thousand. Hence the enormous increases in population of modern years. M. Hardy, a French scientist, is quoted to the effect that an equal distribution of the total proteids annually available in foods would give each individual only two-thirds the amount necessary for physical efficiency and that this shortage would exist even if the underfed masses of India and China were eliminated from the calculation.

Populations Cannot Increase Indefinitely

Opposed to the obvious remedy for such conditions a number of factors operate. Because the exploitation of a virgin America, the development of transportation facilities, and industrialized mechanics permitted large increases in the population of the temperate zones during the last century with some actual increase in comfort for all, it is popularly conceived that this increase in numbers can go on indefinitely without bringing into operation the law of diminishing returns. Here it is overlooked, first of all, that the former food reservoirs are rapidly developing their own industrial civilization and increasing their populations correspondingly, so that shortly they will not produce an export surplus of food. The United States has only recently arrived at this very point; New Zealand, Australia, Chile, and Argentina will follow.

The Race Preservation Instinct

A second difficulty is the instinct of race preservation and national expansion, already referred to, which has for its practical basis the militarist need for man power and the capitalistic requirement of cheap labor. In view of the war extremities then prevailing one can forgive the statement of Sir Bernard Mallet in his presidential address before the Royal Statistical Society on November 20, 1917,[14] to the effect that many people see

[14] Sir Bernard Mallet: Vital Statistics As Affected by the War, *Journ. Royal Statistical Soc.*, Vol. 81, 1918, pp. 1-36. London.

in the declining birth rate of Europe a cause for congratulation in view of the foreseen shortage in the world's food supplies, but he, even if this shortage is actually impending, which he doubts, would be unable to look with indifference on the phenomenon of the declining birth rate. "His attitude towards the general problem of population was decided by the instinct of race preservation." He might have taken heart if he had considered the record of the "degenerate" French during the war and the facts of population in New Zealand and Holland as set forth below.

Religious Teachings

The third and last difficulty in bringing about any reduction in national increase is the influence of religious teaching. "Be fruitful and multiply," "replenish the earth," "the Lord will provide" are the precepts of the Old Testament Jewish, the Confucian, and the Indian religions alike. The Chinese and Japanese ideas of ancestor worship are akin to these religious precepts in their effects on population increase. Such religious teachings may have been well enough adapted to the times when they were first promulgated, but they scarcely fit now. There will no doubt be readers of these lines whose religious susceptibilities will be offended by such attitude, but, before they take up the cudgels with the humble author or Mr. Bland or the authorities he quotes, let them consider first the apparently well-authenticated fact that the clergy of the Church of England, who continue to urge an unrestricted birth rate and who forty years ago practiced what they preached (for the birth rate of their group was above the national average), now have a birth rate near the bottom of the list, close to that of the medical profession and the teachers, who are lowest, and only one-half that of the coal miners and the agricultural laborers, who head the list!

Better People Needed Rather Than More

The other and much more rational view is that stated by Professor Bateson, as follows: "To spread a layer of human protoplasm of the greatest possible thickness over the earth—the implied ambition of many publicists—in the light of natural knowledge is seen to be reckless folly. . . . We need not more of the fit but fewer of the unfit."

Infant mortality increases regularly in proportion to the size of the family. In China 75 to 85 per cent of all babies born die in infancy; the birth rate is 50 per thousand. If the death rate of China were reduced to the European level and there were no counteracting forces there would be 4,000,000,000 Chinese in 100 years. In Bombay, India, the infant mortality was 322 per thousand in 1911, in the same year in London it was 91 per thousand. In the following statement the first figure in each class gives the births, the second the deaths, per 1,000 married males under 55 years in England. Upper and middle class, 119:76.4; skilled workmen, 153:112.7; unskilled workmen, 213:152.5. The effect of large families is only to fill graveyards with human waste.

But, it will be urged, reduction in number of births spells race suicide, particularly since, altogether aside from chauvinistic national ideals, the reduction is greatest just in those classes that it is desirable should be perpetuated. Such is not, however, the case. In 1860 the birth rate in New Zealand was high, over 40 per thousand; in 1911 it had declined to 26 per thousand. But at the same time the death rate had been reduced to 9.5 per thousand, the lowest on record, and the natural increase due to the excess of births over deaths sufficed to double the New Zealand population in 44 years. Nevertheless the Bishop of London in 1913, having this low New Zealand birth rate brought to his attention, was constrained to utter grave warning in view of the "glorious fertility" of China and Japan. Of even greater significance to geographers is the record of Holland. In that country birth-rate restriction was made a matter of national policy on humanitarian and eugenic grounds. Between 1881 and 1910 the birth rate fell to 28 per thousand, the death rate to 12.3 per thousand, the lowest in Europe. In the last fifty years the average stature of the Dutch people has increased by 4 inches, and the physical and social status of the population has much improved. The Dutch themselves attribute this betterment of the national stock to education of the poorest and the physically unfit in regard to the evils of families unrestricted in size. Here, again, it will be hard to find any other way to "beat the Dutch."

No Prospect of Decrease of Yellow and Black Races

There is, however, little doubt but that, despite the various difficulties, preventive checks on the birth rate will come to be generally applied in the near future in all temperate lands and among all European peoples. The real danger zone is in the tropical and subtropical lands inhabited and occupied by the yellow and black races. These areas are the potentially great food reservoirs of the future and the naturally complementary trade areas for the temperate lands. In exchange for their raw products we can furnish their peoples with our industrial products. But it seems to be quite well demonstrated[15] that the white race cannot work, flourish, and procreate in such latitudes. Hence development of the tropics must depend on the labor of tropical native peoples.

But these peoples, blacks, Chinese, East Indians, when protected by European supervision from the positive checks of war, pestilence, and famine, tend immediately to fill up their countries to the absolute level of subsistence. In India, owing to irrigation extension and public sanitation introduced by the British, the population increased from an already crowded 287,000,000 in 1891 to 315,000,000 in 1911 without in the least improving the economic conditions of the coolie. Governor Yager[16] has

[15] See Griffith Taylor: The Settlement of Tropical Australia. *Geogr. Rev.*, Vol. 8, 1919, pp. 84-115, for a very careful and authoritative statement on this point: also the writings of Ellsworth Huntington.

[16] Arthur Yager: Overcrowded Porto Rico. *Geogr. Rev.*, Vol. 1, 1916, pp. 211-212.

made very clear the similar effect in an American tropical possession, and a recent publication by the Department of Commerce[17] supplies like facts with reference to Barbados and Jamaica. In fact, of all the West Indies, only in Cuba, where a white South European population predominates, are the standards of living reasonably high according to our measure.

The only alternatives available to combat these conditions, to prevent the tropical peoples from so completely occupying their lands (once positive checks to population growth are removed) that only a meager existence will be afforded the indigenous population and no room be available for plantation culture and export production in exchange for temperate-land manufactures, and, at the same time, to secure the toil of the natives, are: either forced labor under European supervision—virtual slavery, against which all enlightened thought rebels—or the raising of the standard of living among the black and yellow races.

The Difficult Problem of the Tropics

But this last and only solution is not an easy one to apply. The tropics are and must always be the land of tomorrow. What can be done one day can just as easily be done the next, for it will be just the same as that just passed; no necessity for seasonal provision for the future or old age is imposed by climate or the conditions of natural produce. Industrial and agricultural education, a living wage, and extraordinary incentives to purchase and use the comforts and recreations afforded by temperate-land devices, improvement of agriculture by better practices and introduction of labor-saving machinery, substitution of diversified production for the one-crop method that is now typical of each of the different districts, will all help toward such an end. But great problems remain to be solved. Some of the tropical areas are overpopulated, others almost altogether lack inhabitants. The people of the overcongested regions cannot well be moved to those which are thinly peopled. Waters[18] recognized this difficulty on his visit to the Philippines to investigate agricultural conditions; Bowman[19] likewise has called attention to the home-loving instinct which prevents the plateau dwellers of South America from forsaking their barren habitats for the plainly visible luxuriant slopes at lower levels. Nevertheless some such migration is already occurring in the spread of Chinese coolie labor and West Indian black labor to various tropical shores.

[17] Garrard Harris and others: The West Indies as an Export Field, *Special Agents Ser. No. 141*, Bur. of Foreign and Domestic Commerce, U. S. Dept. of Commerce, Washington, D. C., 1917.

[18] H. J. Waters: The Development of the Philippine Islands, *Geogr. Rev.*, Vol. 5, 1918, pp. 282-292; reference on p. 288.

[19] Isaiah Bowman: The Highland Dweller of Bolivia: An Anthropogeographic Interpretation, *Bull. Geogr. Soc. of Philadelphia*, Vol. 7, 1909, p. 160.

FIVE YEARS OF THE PANAMA CANAL: AN EVALUATION*

By ROBERT M. BROWN

The Panama Canal was opened to traffic on August 15, 1914. During the three hundred years since Balboa, the advantages which would follow the completion of the project have been enumerated time and again. Some of these were obvious, such as the shortening of the sea route between New York and San Francisco, while others were more obscure and only prophetically demonstrable, such as the increased use of the Mississippi River waterway. The traffic between the eastern and the western shores of the Americas, never so large as that between the western and eastern shores of the Old World, which resulted in the building of the Suez Canal, was subject to a problematical increase under a shortened sea way, but, over and above this, facilities for the quicker movement of the navy of the United States from its Atlantic to its Pacific seaboard or vice versa were of paramount importance. In this latter argument, the canal might be considered a paying investment regardless of costs and revenues. The canal was opened for traffic a few days after the world war began. In spite of the falling off in commerce due to the war, the canal became a paying investment from the standpoint of actual earnings before the armistice was signed.

Another phase of the canal question which is most amazing is the transformation of the zone from a pestilential area of difficult and dangerous travel to a land where the death rate is less than that of some of our large cities, as well as to a land of well-paved roads and bountiful crops. Some of these results have been beyond the dreams of the most sanguine adherents of canal construction, and the history of the last few years during which the United States has been in charge of the Canal Zone is a record of remarkable achievements.

Catastrophe and disaster are still prophesied as imminent by those who believe that slides and earthquakes have not registered their maximum expression; but, while these are always possible, they appear from the records of the last few years to be fairly remote contingencies, more serviceable as propaganda against the efficiency of the canal than as actual warnings.

The following notes, taken from the annual reports of the Governor of the Panama Canal, give one a résumé of actual operations for a period of years. By means of the results so far achieved we can now test the validity of the earlier theoretical analyses of the value of the canal and gain a clearer idea of its future importance.

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* For an account of the canal shortly before its completion, see J. W. Herbert: The Panama Canal: Its Construction and Its Effect on Commerce. *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 240-254, with map in 1:660,000.—EDIT. NOTE.

Revenue

The tolls levied on vessels passing through the Panama Canal since the opening of the canal (August 15, 1914) to July 1, 1919, amounted to $28,475,285.85. Of this amount a part is uncollectible, as shown below, leaving as the actual revenue of the canal from tolls the sum of $24,810,499.11. Appropriations by Congress for canal purposes up to this time have been $459,443,105.99. For the fiscal year ending June 30, 1919, the tolls collected reached the sum of $6,156,118.95; and the total revenues the sum of $6,354,016.98. The canal authorities claim a loss during the year of $867,526.48—because of a difference between the Panama Canal rules for the measurement of the tonnage of vessels and the rules as laid down by the United States statutes—and a total loss of $3,664,786.74 since the opening of the canal.[1] The main point of divergence in the two sets of rules has reference to the open deck cargo. The Panama Canal rules provide that on vessels carrying stores, timber, cattle, and other cargo on open deck spaces the tolls which are payable on the vessel's net tonnage shall be increased by the tonnage of space occupied by the goods on deck. This ruling was felt particularly by the lumber interests of the Pacific Coast, and upon their protest the Attorney General of the United States decided that the measurement of vessels must be in accordance with the United States rules and that tolls levied in excess at Panama are not collectible. The Panama Canal rate of $1.20 per net ton—each 100 cubic feet of actual earning capacity—was higher, in many instances, than the National rate of $1.25 per ton of net capacity. The difference between these two tonnage rates has (as stated above) amounted to $3,664,786.74, which the authorities at the canal report as a loss but which under the circumstances has no potential value.

For the year ending June 30, 1918, the revenue earned was for the first time in excess of the expenses, leaving a balance in favor of the canal management of $697,556.23. The previous year the expenses exceeded the revenue by $979,648.90;[2] and to July 1, 1919, the expenses have been in excess of the revenue by $4,618,690.75. During the last fiscal year the revenues were in excess of current expenses by $241,822.21.[3] The increase of revenue from tolls and the maximum yearly revenue which could be confidently looked for with a normal increase each year in the number of vessels using the canal depend at present on the possible number of lockages which can be permitted by the available storage capacity of the reservoirs.

Vessels Using the Canal: Present and Future

The average number of lockages made at all locks for each month of the fiscal year ending June 30, 1918, was 195.39, or about 6.5 through lockages

[1] *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1919*, Washington, D. C., pp. 22, 170, 188.

[2] *Ibid., 1918*, pp. 26, 186, 205.

[3] *Ibid., 1919*, p. 188.

per day. The greatest number of lockages made in any month occurred in May, when the Atlantic locks made 229 and the Pacific locks 225. During the year, a total of 2,130 vessels[4] passed through the canal with an average for three stations, Gatun, Pedro Miguel, and Miraflores, of 2,345 lockages.[5] This average for the year ending June 30, 1919, fell to 2,313.[6] The number of ships passing through the canal exceeds the number of lockages because of the possibility at times of passing more than one ship through in a single lockage.

This number of lockages did not tax severely the storage capacity of Gatun Lake. In general it is planned to have this lake at or near its maximum allowable elevation, plus 87 feet, at the beginning of the dry season, which roughly includes the first four months of the calendar year. During the fiscal year ending June 30, 1918, the elevation of the lake was plus 87.06 feet at the beginning of January, and this level had not been lowered appreciably on February 1. The minimum elevation for the year occurred on April 21 at plus 84.52 feet.[7] For the year ending June 30, 1919, the maximum elevation occurred in January, when the water stood at plus 85.56. The minimum elevation, in April, was 84.15 feet.[8] Practically all the water above plus 80 feet is available for use. The bottom of the canal through the lake is 40 feet above sea level, and the lowering of the lake below plus 80 feet would reduce the depth of water for floatments below 40 feet. It was estimated that the water in the lake not used during the dry season of 1918—that is the water between plus 84.52 feet and plus 80 feet—even with allowances for proportionate depletion for other things than lockages was sufficient to provide for 15 complete canal lockages daily instead of the 6.5 daily average which was actually made. A large part of the water depletion as shown below is fed to the hydro-electric generating plant; and it was further estimated that by conserving the amount furnished for this purpose the upper limit of lockages might be increased to 36 a day.

The maintenance of the water level of Gatun Lake above plus 80 feet depends on the available supply yielded by the hydrographic basin, the consumption for canal purposes, the depletion other than consumption, and the further possibilities for water storage.

The rainfall over the Gatun watershed has averaged for thirteen years 126.45 inches a year.[9] The three driest months—January, February, and March—have a monthly average of 2.8 inches. Of the waters of the lake lost or consumed during the fiscal year, about 69 per cent went in spillway discharge. During nine months of the year, the water is in excess of the demands for all purposes and has to be freed; it is only during the dry period of three and a half months that the rainfall is insufficient to meet the needs of the canal and the auxiliary plants. Thus a storage capacity in the lake is necessary, and the footage between plus 80 feet and plus 87 feet.

[4] *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1918*, Washington, D. C., pp. 135, 137.

[5] *Ibid., 1918*, p. 44. [6] *Ibid., 1919*, p. 42. [7] *Ibid., 1918*, p. 45. [8] *Ibid., 1919*, p. 43. [9] *Ibid., 1918*, p. 86.

until other arrangements are made, must tide over until the rain becomes heavy. No immediate need of extra storage seems imminent.

The consumption of water for lockages during a year is only 7 per cent of the total lost or used. Next to the spillway discharges from the excessive rains (69 per cent), the hydro-electric station uses the greatest amount of water, 14 per cent of the total. About 9 per cent is lost by evaporation, and the remaining 1 per cent is divided among leakages, transfers, and pumping.[10] Altogether about 78 per cent of the water flowing out of the Gatun watershed during the last fiscal year was lost, that is was not used for any purposes relating to the canal; only 22 per cent was actually consumed on the plant projects. There is water enough for additional storage. In case lockages during any dry season drain the lake level to plus 80 feet, it is the plan to feed less to the hydro-electric plant and thereby save water in storage for actual ship floatments. The maintenance engineer of the canal is of the opinion that during an average year it will be possible to operate the hydro-electric station at full projected capacity, using 3,260 cubic feet of water per second, and take care of about 21 complete canal lockages daily throughout the dry season without utilizing additional storage. With any increase in this estimate of daily lockages, water will have to be drawn from the allowance of the power plant. "With 36 canal lockages daily during the driest year of record, it will be necessary to cut the water used for power development to about 900 cubic feet per second throughout the dry-season months, which is sufficient to operate the hydro station at about 25 per cent of its full projected capacity."[11] The future increase of the canal traffic up to this optimum will have to be met in one of two ways: either by using the auxiliary steam plant in place of the hydro-electric station during the dry season so as to conserve water or by finding a way to impound more of the water of the wet season which is lost by spillway discharges.

During the year ending June 30, 1919, about 40 per cent of the total number of vessels passing through the canal were from the United States; 30 per cent were British; 6 per cent Norwegian; 5 per cent French; and 4.5 per cent Chilean; the rest were mainly Japanese, Danish, and Peruvian. The gross tonnage was 7,876,703.[12] For 1914 the gross tonnage passing through the Suez Canal was 26,866,340.

Slides

The canal up to July 1, 1919, has been closed by obstructions due to slides 242 days out of a possible 1,537 days. Of this time 210 days were a consecutive period lasting from September 18, 1915, to April 15, 1916. Of the entire length of the canal, about 35 miles between mean tide levels, only the portion between the Pedro Miguel locks, the highest on the Pacific side,

[10] *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1918.* Washington, D. C., p. 45.

[11] *Ibid., 1918,* p. 93.

[12] *Ibid., 1919,* pp. 119, 120.

and Bas Obispo, near Gatun Lake, is subject to slides. This cut across the highest part of the Isthmus, formerly called Culebra Cut and now officially called the Gaillard Cut after the late David Du Bose Gaillard, one of the leading engineers of the canal, passes through rock for 8¾ miles; and of the Gaillard Cut only about 2,800 feet at Culebra Hill and 2,000 feet at Cucaracha Hill have been troublesome slide locations. Two and one-half per cent of the entire length of the canal, therefore, or about ten per cent of the Gaillard Cut constitutes the length affected by slides. The slides caused by the slipping down of loosened earth on steep slopes are small in extent and relatively insignificant; the more common type of slides in the Gaillard Cut have apparently resulted from the unbalancing of the established equilibrium in digging the canal. The lateral support of the hills on both sides of the canal in the Culebra district was, considering the peculiar nature of the native rocks, more important than had been determined in the original specifications. When this support was removed, the weight of the hills on each side of the Gaillard Cut in the Culebra district was sufficient to cause a movement outward from the hills into the canal where the pressure had been removed. Coincident with the lateral movement of the banks into the canal an elevation of the bottom of the canal, due probably to the same cause, occurred. Thus on September 18, 1915, the date of the beginning of the big slide, both banks began a strong movement into the canal prism; and on the next day an island, the result of upheaval, appeared in the canal. At its greatest height, the obstruction in the canal, during this slide, covered a distance of 255 feet of canal length, and the débris stood 65 feet above the mean water level in the canal.[13]

It is not so much the purpose here to enter into the details of slide causes as to state, as fairly as can be determined, the conditions which may affect the use of the canal as a waterway. The closing of the passage for 232 days in a single year so soon after the opening of the canal tended to destroy confidence in a sure and safe passage through it. The wide publicity given to the slides in papers and magazines emphasized the accident as a recurrent feature rather than as an unusual phenomenon. During November, 1915, at the request of the President of the United States, a committee of the National Academy of Sciences was appointed to consider the possibilities of controlling the slides. The final paragraph of their preliminary report is quoted:[14]

> The committee looks to the future of the canal with confidence. It is not unmindful of the labor necessary to deal with the present slides; and it realizes that slides may be a considerable, but not an unreasonably large maintenance charge upon the canal for a number of years; it also realizes that trouble in the Culebra district may possibly again close the canal. Nevertheless, the committee firmly believes that, after the present difficulties have been overcome, navigation through the canal is not likely again to be

[13] *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1916*, Washington, D. C., p. 32.

[14] *Ibid., 1916*, p. 598.

seriously interrupted. There is absolutely no justification for the statement that traffic will be repeatedly interrupted during long periods for years to come. The canal will serve the great purpose for which it was constructed, and the realization of that purpose in the near future is assured.

The committee bases this confident conclusion of their investigations on the fact that the soft rock which has been the primary cause of the slides is limited in extent and that the harder rock has displayed no tendency to move. Since their investigations, the history of slides in the canal has been in accord with these findings.

At the end of the next fiscal year, June 30, 1917, in summing up the report on slides, it is found that the Cucaracha slide became active late in August, 1916, and traffic was suspended through the canal for a period of eight days ending September 7; and that the Culebra slide was fairly active during the year but was not sufficiently so to close the canal except for two days, January 10 and 11, 1917.

At the end of the fiscal year ending June 30, 1918, the Cucaracha slide is reported to have been at no time a menace to navigation, and the Culebra slide, although it continued its action, did not at any time close the channel or delay shipping. There is a promise of making this district permanently free from slides by a small (in comparison with what has been removed) additional amount of earth removal. During this year another unstable region near West Culebra menaced navigation, but the trouble was discovered and remedied before becoming serious. No "difficulty in maintaining full width and depth of the channel in the Culebra slide region"[15] is the report for the year ending June 30, 1919.

In concluding this survey of the slides, it is safe to assert that accidents to the canal from this cause may be confidently expected to be fewer and fewer. It would be fortunate indeed if no further blockage of the waterway by slides were to be recorded; but this is perhaps too much to hope for. The canal is not yet out of danger from this cause of obstruction; but it is apparently out of danger of a prolonged period of closing.

Earthquakes

The entire Isthmus is in an area subject to seismic disturbances, and the threat of a severe earthquake hangs over the whole Canal Zone. It is impossible to forecast the expectable damage in case of a severe earth shake. The records during the last few years demonstrate little more than the fact that earth shakes are common. For the year ending June 30, 1916, there were recorded 59 tremors, practically all of them of local origin. The heaviest did considerable damage to the wharf of the United Fruit Company at Bocas del Toro. This shock was recorded as V on the Rossi-Forel scale of I to X and in translation would read "shock of moderate intensity." During the following year 32 tremors were recorded, of which seven were of distant origin, the epicenters ranging more than 1,000 miles away. The

[15] *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1919*, Washington, D.C., p. 15.

heaviest shock recorded had an intensity of IV, which is translated as "feeble." For the year ending June 30, 1918, 30 disturbances were recorded, and the heaviest shock had an intensity of III (very feeble). For the next year, 46 disturbances were noted, all slight tremors from shocks of distant origin.

Sanitation

The canal in its future possibilities must render an almost unbroken passageway not only free from danger of a physical nature but also free from the danger of encountering contagious diseases. The work of the Health Department, therefore, is as necessary and must be as effective as that of the Engineer of Maintenance. The achievement of this sanitary department is a notable one, and a traveler may be assured of a safe transit of the Canal Zone so far as tropical diseases are concerned. The French kept no record of their sick rate during the years from 1881 to 1889, but it has been estimated at one-third of their force, or 333 per 1,000. The American rate was 23 per 1,000 per day during the ten years of construction with a force of 39,000 men. During the same period the death rate among employees was 17 per 1,000; which made about 663 deaths per year. The French rate was 200 per 1,000. In 1906, when the malaria rate was the highest, 821 persons out of every 1,000 were admitted to the hospitals suffering with this disease. In 1913 this rate had been reduced to 76. In 1916 the rate was 34; in 1917, 13.47; and in 1918, 20 per 1,000. The death rate for the year ending June 30, 1916, from all causes was 23.53 per 1,000; for the next year 23.46; and the next 22.21; and for the year 1918-1919 it was 20.44. When it is considered that the death rate in the United States is about 16 per 1,000 (ranging from 22 in cities to 14 in rural districts), one feels safe in asserting that danger from diseases in the Canal Zone area has been reduced to a minimum. The labor expended in accomplishing this wonderful result has been large, and it is only maintained by vigilance and untiring care. During 1918, for instance, bubonic plague raged along the South American coast from Valparaiso northward; yellow fever was spreading through Guayaquil and the surrounding country; smallpox broke out in Bluefields, Nicaragua, and in Cartagena, Colombia; and the plague was rampant in Venezuela. All these places were points of call for vessels bound through the canal, yet no case of plague, smallpox, or yellow fever was reported in the Canal Zone. The quarantine stations protecting the entrances to the canal are sufficient safeguards against all these conditions. The tables of quarantine service show for the ports of Panama and Colon for 1919 that 174,194 persons were inspected, 6,882 persons vaccinated, and 17,254 persons held in quarantine. The conclusion of the matter appears to be that there is some danger of contracting disease in the passage to the canal (increasing in proportion to the number of calls the vessel makes) and that there is very little danger from contagious diseases in the canal district. It is an evidence of the efficiency of this service that

the influenza, which swept the world during the last months of 1918, was little felt in the Canal Zone; this was due probably to the special quarantine against influenza.

Economic Opportunities of the Canal Zone

With the eradication of the dreaded tropical diseases from the Isthmus, the Canal Zone and its neighborhood should attract settlers; particularly as the opportunities for raising tropical products appear alluring. During 1917 Panama City alone exported bananas to the value of two and a half million dollars; coconuts to the value of three-fourths of a million; balata, half a million; hides, a third of a million; and many other native products in smaller values.

The assets in the Republic of Panama may be briefly summarized:

(1) Topography. There is within a short distance a range of altitudes which will furnish resorts for persons not accustomed to the tropical climate. The land may be considered as about one-third semi-tropical (altitudes ranging from 2,000 to 6,000 feet) and about two-thirds tropical. It is estimated that there are about 3,000,000 acres of land above 3,000 feet which, when made accessible by good roads, will be suitable for colonizers of the white race.

(2) Production. The yield of coconuts, ivory nuts, balata, bananas, and native woods is far short of the possibilities. Verner[16] states that in Panama there are 2,000 square miles of coconut lands capable of sustaining 100,000,000 trees yielding a yearly product worth $200,000,000; that the yield of ivory from wild palms is far below the available, and cultivation would increase the output thirty fold; and that there are 5,000,000 acres suitable for the cultivation of bananas which would yield at a conservative estimate $400,000,000 as against $2,000,000 in 1917. Whether or not such estimates are easier on paper than on the Isthmus, there appears to be good ground for considering an immediate increase in the exports likely. Shipments would of course be a relatively simple matter.

It is not surprising that in an area so advantageous for crop production the supply department of the Canal Zone is reducing the dependence of the population upon outside sources for foodstuffs. During recent years, it has been possible to supply the inhabitants and the steamships passing through the canal with beef and pork products without importations of this staple. Chicken and dairy farms are maintained. Under the control of the supply department, there are thirteen plantations which have provided a sufficient quantity of fruits and vegetables for local consumption.

Altogether, the people of the United States can look to the achievements at Panama with pride. Many of the lines of endeavor here brought to a successful fruition are examples of skillful management and trusteeship that have been wrought without the aid of previous experience. The workers have in these lines blazed a new trail for the nations of the earth.

[16] S. P. Verner: Panama—Past, Present, and Future. *Bull. Pan Amer. Union*, Vol. 48, 1919, pp. 125-144, Washington, D. C.

THE NATURAL REGIONS OF THE BALKAN PENINSULA (AFTER CVIJIĆ)

[With separate map, Pl. II, facing p. 204.]

The Balkan Peninsula lies at a meeting point of three of the great world regions—Central Europe, the Eurasiatic steppe, and the Mediterranean. The conformation of the peninsula is such that it is to a considerable degree open to the penetration of influences and the movements of population from all three regions. Within the peninsula the course of these influences and movements is directed and restricted by barriers that divide the peninsula into a certain number of natural regions. The definition of these natural regions forms the groundwork of Cvijić's exposition of the human geography of the peninsula in his recent great work "La Péninsule Balkanique."[1] The accompanying map (Pl. II) attempts to interpret this definition cartographically.

The Physical Basis of the Natural Regions

The Hellenic portion of the peninsula, deeply indented into headlands and gulfs pointing southeast towards Asia Minor, is united to the Mediterranean shores of that region by the island-sprinkled Aegean, one of the most friendly seas of the globe. In comparison the Black Sea shores are little indented, but Pontic influences travel also by landways round the sea, by the arid Anatolian steppes, and the narrow straits—sunken river valleys only—and Constantinople, or via the South Russian steppe. The northern frontier of the peninsula west of the Carpatho-Balkan arc is likewise open. The Danube and its tributaries, of which a convergence on Belgrade is noteworthy, give access to Central and to Western Europe. Within restricted limits the Adriatic has played something of the rôle of the Aegean. Great longitudinal depressions traversing the peninsula from northwest to southeast carry peripheral influences inward. To a less degree passes and transverse valleys afford west-east lines of movement. Between these depressions and transverse roads are the vast mountain massifs which separate the major natural regions of the peninsula while themselves constituting regions isolated and individualized. In the words of Cvijić the functions of the two sets of features are respectively "union and penetration" and "isolation and separation." These morphological features, and not the human elements integral in the geographical region proper, constitute the initial basis of the delimitation into natural regions. Because of the broken history of the peninsula, which in turn is related in large meas-

[1] Jovan Cvijić: La Péninsule Balkanique: Géographie humaine. viii and 528 pp.; maps, diagrs., ills. Armand Colin, Paris, 1918. 17 frs. 10 x 6½ inches.

ure to these characters of union and penetration, isolation and separation,[2] ethnic and social differentiation—human adjustment to the great natural regions—is incomplete and imperfect. It may be remarked that the distribution of one great aspect of human geography, "psychic character," involving many other characters than the geographic, is separately treated by Cvijić in the second part of the volume.

The Aegean Region

The Hellenic Region

The most fundamental division of the Balkan Peninsula is into a continental and a peninsular area, the Continental Block and the Aegean Region. The Hellenic Region (1 on map, Pl. II), opening onto the Aegean, turns its back on the Continental Block. Morphological separation is reinforced by climate and its correlative circumstances (for the climatic zones, see map, Fig. 1). Greece, with its rainless summers and *maquis* vegetation, is the typical Mediterranean country. Cultivation, restricted by areal limitations, is "in miniature." The population is turned seaward, where opportunities for fishing, navigation, and trade are unrivaled. In contrast with the essentially rural and agricultural Continental Block, the Hellenic Region is a land of particularism and city life.

The Thraco-Macedonian Littoral Transition Region

Certain characteristics of the Hellenic coast lands are displayed on the Thraco-Macedonian shores of the Aegean, a transition region (2) between the Continental Block and the Aegean Region. The climate is less distinctly Mediterranean; some rain falls in summer, the winters are more severe, the cornfields are larger, and the olive is less prominent in the landscape. The valleys of numerous watercourses give access to the interior and invite a different mode of life. The Thraco-Macedonian littoral has been especially the theater of Byzantine civilization, with its center at Constantinople. The transition character of the region is reflected in the population by their maintenance of distinctive traits. Whereas the highly individualized manner of life in the Hellenic peninsula has Hellenized Slav intruders, Slavs and Greeks remain side by side unassimilated in the Thraco-Macedonian littoral.

The Continental Block

The Lower Danubian Plateau

The Continental Block falls into three major natural regions: Eastern, or Balkan; Central, or Morava-Vardar; Western, or Pindo-Dinaric. The

[2] Discussed by Miss M. I. Newbigin in "The Problem of the South Slavs (Yugoslavs)," *Scottish Geogr. Mag.*, Vol. 35, 1919, pp. 1-5.

Balkans, which continue the mountain arc of the Carpathians, and the Rhodopes together cut off the portion of the peninsula opening eastward. The Balkans separate a region of Mediterranean drainage from a region draining to the Danube and on the open road to Russia and the steppes. Here, on the Lower Danubian Plateau (3), is a distinct impress of the steppe. The climate is of continental extremes; the loess-covered slopes, exhibiting a uniformity rare in the peninsula, are of a wonderful fertility, but the wheat harvests fluctuate seriously under the liability to summer drought. Migrations from the Asiatic steppes to the plateau have had a special significance. Hither, following Slav invaders, came the Ugro-Finnish Bulgars, who fused with the Slavs, forming the basis of the present Bulgar people. They brought with them a military organization foreign to the Slavic tribes; the well-defined region offered favorable conditions for the establishment of a state, and here—towards the end of the eighth century—was formed the first Yugo-Slav state of the peninsula.

Between the Lower Danubian Plateau and the southern division of the Balkan Region relations have been close. Except in the central part the Balkan Range presents no special difficulties to movement. There are numerous passes by which the Bulgars have penetrated into Thrace and by which inversely Turkish peoples and dominion have traveled north. The complete submission of Bulgar to Turkish power was proportionate to the easy reach of Constantinople and the agricultural organization of the region. But individuality of civilization is not less marked. The Balkans figure as a part of the boundary between the two great civilizations—patriarchal and Byzantine—of the Continental Block, and psychic differences between the populations are very marked.[3]

The Maritsa Basin

The second division of the Balkan Region, the Maritsa Basin (4), lying between the Balkans and the Rhodopes, is a natural unit of another order. A more diversified relief and a climate where steppe and Mediterranean influences mingle create an agricultural region whose resources—they include wheat, maize, tobacco, peppers, rice, vine, mulberry, fruit trees—are far more varied than those of the Lower Danubian Plateau. They contribute to the formation of the most complete geographic unit of the peninsula. In contrast to the Lower Danubian Plateau the Maritsa Basin is thoroughly Byzantine (with modifications through Turco-Oriental influences), for there is no hindrance to the spread of influence from Constantinople.

The Sub-Balkan Depression (4a), a series of small tectonic basins, is a minor unit whose affiliations are more particularly with the Maritsa Basin.

[3] See the map "Zones de civilisation," 1:6,000,000, Pl. II in Cvijić's volume, facing p. 100—the same map in color and on a larger scale, 1:3,000,000, in the *Geogr. Rev.*, Vol. 5, 1918, Pl. V—and the map "Types et variétés psychiques des Yougoslaves," 1:3,000,000, at the end of the volume.

The Upper Isker Basin Region

Farther west, between the Balkans and the Rhodopes, is a region (5) which includes the Upper Isker basin and the watershed traversed by the Belgrade-Constantinople railroad. Apart from small cultivated basins, it is an elevated, deforested country, poor in resources.

Unity of the Morava-Vardar Region

The Central, or Morava-Vardar, Region derives its unity from the great longitudinal furrow that traverses it from northwest to southeast. This unity is expressed in the historical tendency for a single state to control the entire furrow. The medieval Slav states pressed southward; the Turk followed in the inverse direction; and we now have the present-day efforts of Serbia to reach Saloniki. But the furrow has a double outlook; characters of isolation and separation intervene, and three divisions of the region may be recognized.

The Morava, or Shumadiya, Region

The Morava, or Shumadiya, Region (6) north of Nish is a well-defined morphological unit. A terraced plateau sloping towards the Danube, it corresponds in effect with the southern limit of the Neogene Pannonic lake. Comparatively gentle contours, a fertile lacustrine soil, a climate of somewhat modified Central European type, with abundant rain and a particularly long autumn, create a region admirably adapted to the agricultural predilections of its inhabitants. The Shumadiya is the plum country and also the maize and pig-raising country *par excellence* of the peninsula. The opening up of this forested region began comparatively late, chiefly through the Serbs who sought refuge there in the course of the migrations provoked during the period of Turkish rule.[4] Far from Constantinople and in close touch with the countries beyond the Danube, the Shumadiya not unnaturally became the center whence sprang the Serb renascence.

Closely similar to the Morava Region is the country to the west, Bosnia (6a), which may be considered either as an extension of the Shumadiya or as the Pannonic part of the Dinaric Region.

The Central, or Rashka, Region

South of Nish is an elevated region of morphological complexity whence there is drainage to three seas. The distinguishing feature of this region is the series of tectonic basins in which, and not along crest lines, lie the chief watersheds. This peculiarity greatly facilitates communication, and several routes converge on the region: Nish and Skoplye in particular are

[4] See the note on "The Internal Migrations Underlying the Present Distribution of the Serbo-Croats." *Geogr. Rev.*, Vol. 5, 1918, pp. 418-419.

nodal points. The basins with their former lake floors are fertile, the encompassing mountains support fine pastures, and the region is further distinguished by its mineral wealth. This is Rashka, "Old Serbia" (7), center of the ancient Serbian state.

The Vardar, or Macedonian, Region

From the morphological point of view there is no marked distinction between the central and the southern division of the Morava-Vardar Region. Distinction lies in the extent to which the southern division, the Vardar, or Macedonian, Region (8), has been influenced from the Aegean, an influence that, indeed, is already apparent in the climate and productions of the Skoplye basin. There is a marked difference, however, between the Vardar and Struma basins (8b) and the Macedonian lake region (8a). The latter elevated country rather resembles the central region in the products of its cultivated basins and its pastoral pursuits. Placed between two littorals supporting winter pasturage, the mountains of western Macedonia are the great domain of *transhumance*.[5]

The Dinaric Region

The Western, or Pindo-Dinaric, Region, is delimited by a line of depressions running southward from the basin of Laibach (Lyublyana) to the Gulf of Arta. Unlike the Morava-Vardar Region or the Maritsa Basin the Pindo-Dinaric Region is lacking in a unifying center or centers. Even the cultivable basins (*polye*) of the karst are of insignificant extent. Yet in the Dinaric, or northern, section (9), from Karlovats to Scutari, the physical and psychic type of the population, ethnically the purest of the peninsula, and the language are almost uniform; while from Carniola to eastern Montenegro the same Alpine house type persists. This is primarily a reflection of the unity of the pastoral life of the mountains, which has been greatly facilitated by the absence of deep transverse valleys. On the other hand there is a distinct break between the *planina*, or mountain plateaus, and the *primorye*, or littoral, permeated by Mediterranean influences and looking towards western Europe, especially Italy. These two zones are separated by the barren *zagora*, the poorest country of the peninsula, lacking alike the maritime resources of the littoral and the pastures and forests of the *planina*.

The Pindus Region

In the Pindus Region (10), encompassing Albania and Epirus, the factors of isolation and separation are most highly developed. Mountains on

[5] On *transhumance* see the notes entitled "Illustrations of Seasonal Migration from Switzerland and the Dinaric Countries" and "The Geography of the Waldensian Valleys in the Italian Alps," *Geogr. Rev.*, respectively Vol. 6, 1918, pp. 73-74, and Vol. 7, 1919, pp. 265-266.

the east, delta and lagoon shore and marshy coastal plain on the west, isolate the region as a whole, while it is divided in itself by the existence of deep transverse valleys. This is a contributing cause to the intensity of

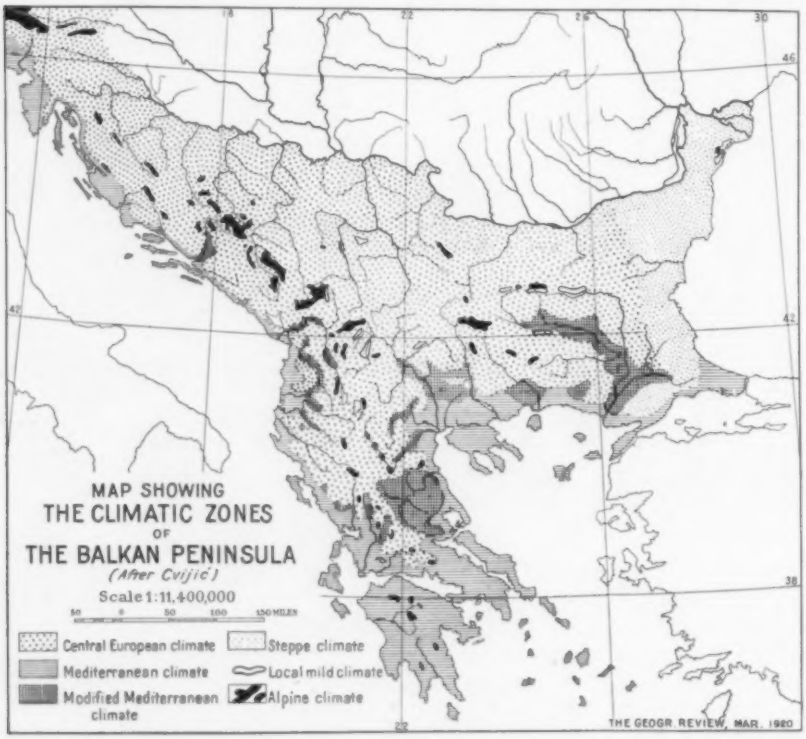
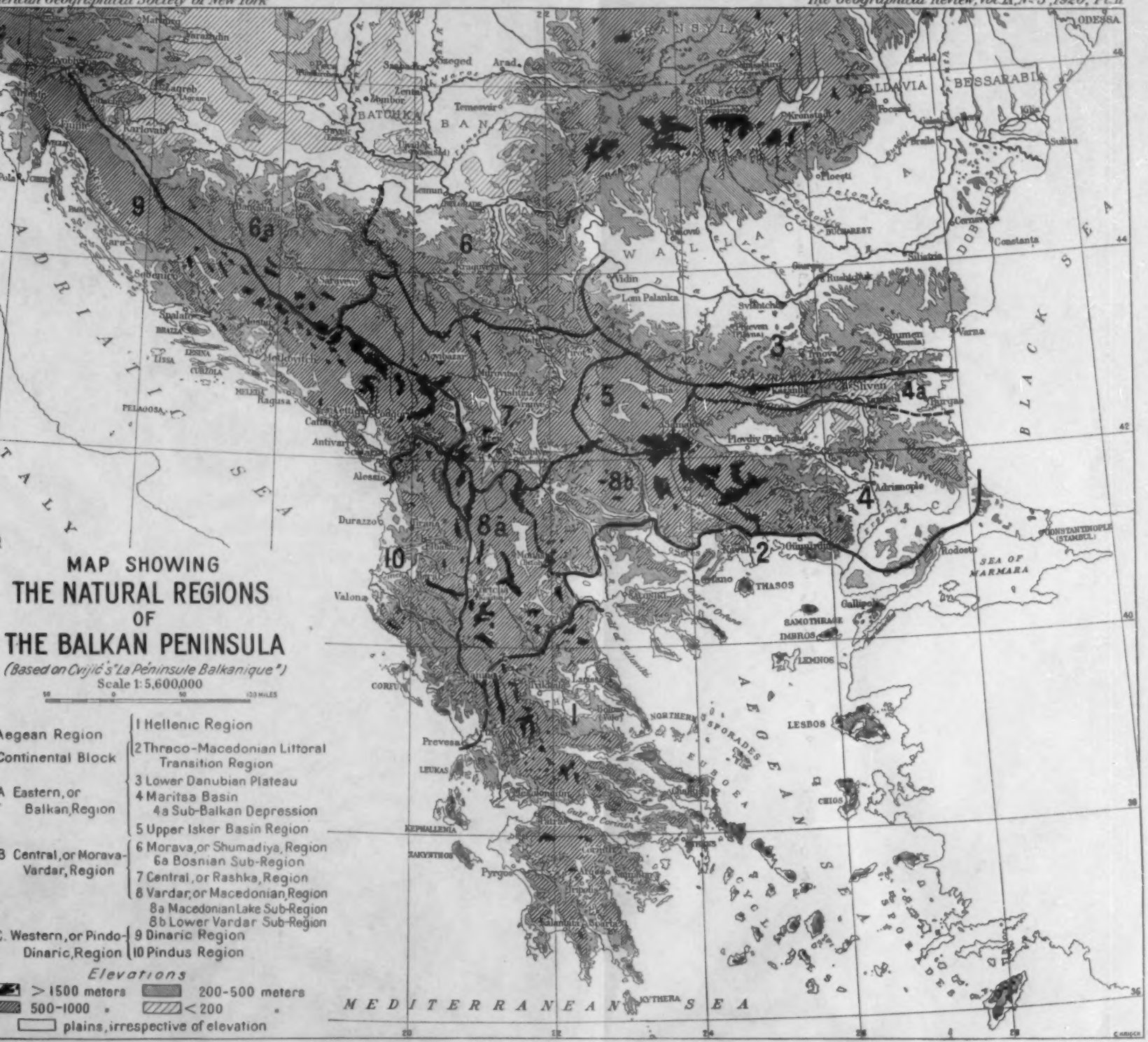


FIG. 1

tribal life and to the general backwardness of the region. The country is well provided with forests, meadows, and upland pastures; it is, in fact, much better endowed with natural resources than is commonly imagined.


MAP SHOWING
THE NATURAL REGIONS
OF
THE BALKAN PENINSULA
(Based on Cvijić's "La Péninsule Balkanique")
Scale 1: 5,600,000
50 0 50 100 MILES
Aegean Region
Continental Block
A Eastern, or Balkan Region
B Central, or Morava-Vardar, Region
C Western, or Pindo-Dinaric, Region
1 Hellenic Region
2 Thraco-Macedonian Littoral Transition Region
3 Lower Danubian Plateau
4 Maritsa Basin
4a Sub-Balkan Depression
5 Upper Isker Basin Region
6 Morava, or Shumadiya, Region
6a Bosnian Sub-Region
7 Central, or Rashka, Region
8 Vardar, or Macedonian Region
8a Macedonian Lake Sub-Region
8b Lower Vardar Sub-Region
9 Dinaric Region
10 Pindus Region
Elevations
> 1500 meters
500-1000 "
200-500 meters
< 200 "
plains, irrespective of elevation
TRANSYLVANIA
MOLDAVIA
BESSARABIA
BANAT
BATCHKA
WALLACHIA
DOBRUDJA
ODESSA
BUCHAREST
Constanta
Varna
Adrianople
CONSTANTINOPLE (STAMBUL)
SEA OF MARMARA
Rodosto
Gallipoli
THASOS
SAMOTHRACE
IMBROS
LEMNOS
LESBOS
CHIOS
NORTHERN SPORADES
AEGEAN SEA
EUBOEA
CYCLADES
CRETE
KYTHERA
MEDITERRANEAN SEA
BLACK SEA
ADRIATIC SEA
IONIAN SEA
Gulf of Corinth
Gulf of Salonika
Gulf of Orfano
Durazzo
Valona
Alessio
Ragusa
Spalato
Sebenico
Fiume
Agram
Belgrade
Arad
Temesvar
Ploesti
Braila
Galatz
Kronstadt
Sofia
Philippopolis
Adrianople
Salonika
Monastir
Prevesa
CORFU
LEUKAS
KEPHALLENIA
ZAKYNTHOS
Pyrgos
Tripolis
Sparta
Kalamata
Athens
Larissa
Volo
Trikkala
Janina
Scutari
Cattaro
Antivari
LISSA
LESINA
CURZOLA
MELEDA
PELAGOSA
BRAZZA
Lom Palanka
Vidin
Rustchuk
Silistria
Turnu-Severin
Orsova
Nish
Uskub
Mitrovitza
Novi Bazar
Ipek
Prizrend
Prishtina
Kossovo
Kragujevatz
Semlin
Zemun
Essek
Sarajevo
Travnik
Banjaluka
Karlovatz
Agram
Varasdin
Marburg
Szegedin
Zombor
Zenta
Temesvar
Orsova
Turnu-Severin
Lom Palanka
Vidin
Rustchuk
Silistria
Varna
Shumen
Sliven
Burgas
Philippopolis
Adrianople
Rodosto
Gallipoli
Salonika
Monastir
Uskub
Mitrovitza
Novi Bazar
Ipek
Prizrend
Prishtina
Scutari
Cattaro
Ragusa
Spalato
Sebenico
Fiume
Agram
Karlovatz
Varasdin
Marburg
Szegedin
Arad
Temesvar
Zombor
Zenta
Semlin
Zemun
Essek
Sarajevo
Travnik
Banjaluka
Kragujevatz
Kossovo
Ploesti
Braila
Galatz
Kronstadt
Sibiu
Constanta
Durazzo
Alessio
Antivari
Janina
Volo
Larissa
Trikkala
Athens
Sparta
Kalamata
Tripolis
Pyrgos
Prevesa
Gulf of Arta
Gulf of Corinth
Gulf of Salonika
Gulf of Orfano
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MACKINDER'S 'WORLD ISLAND' AND ITS AMERICAN "SATELLITE"

By CHARLES REDWAY DRYER

Mackinder's "Democratic Ideals and Reality," sketched, supplemented, and pruned by Professor Teggart in a recent number[1] of the *Review*, seems to justify the comment made by a Scotch geographer on the appearance of his "Geographical Pivot of History:"[2] "Mr. Mackinder's power of generalization is something positively uncanny." Now he has found the master key to history in the age-long struggle between the barbarous "Heartland" and the civilized coastlands of the "World Island." In dealing with conceptions of such scope and portent, perhaps it is not strange that he has failed to see the real significance of one factor, and that is America. He refers to it as "a certain pair of peninsulas . . . for practical purposes insular rather than peninsular" and classes them with Australia as "merely satellites of the old continent." He sees North America as lying off the great World Promontory which ends at the Cape of Good Hope and as analogous to the island of Crete off the Hellenic peninsula and Britain off the Latin peninsula.[3] Disregarding the strain to which such a view subjects the imagination and the map, it seems to miss the real geographical significance of America.

America As the World Ring

The ancient and medieval geographers thought that the *oecumene*, or habitable world, formed one continuous land mass extending from Spain to China. Columbus incidentally upset this doctrine and opened the way to the discovery that there is a second oecumene, also forming one continuous land mass, 2,000 miles longer than the first but extending in a transverse direction. It is true that the New World has but half the area of the Old World, but its area is not so important as its form and position. On a flat surface it is geometrically impossible to represent a slightly skewed bar as surrounding anything, but on a spheroidal surface this is not so absurd. America is not an island in any such sense as Australia is. It forms an unbroken bar of land extending from one polar ocean to the other and lying between the European Coastland and the Monsoon Coastland of the World Island. The fact that a bar is slender midway of its length does not prevent its being a bar. Whether a ship sails from the World Island in a westerly or an easterly direction, it will come up against

[1] F. J. Teggart: Geography As an Aid to Statecraft, *Geogr. Rev.*, Vol. 8, 1919, pp. 227-242.

[2] *Geogr. Journ.*, Vol. 23, 1904, pp. 422-444.

[3] H. J. Mackinder: Democratic Ideals and Reality: A Study in the Politics of Reconstruction, New York, 1919, pp. 80, 82, 83.

the bar, as Columbus did. Thus in effect America, with the Arctic ice fields and the Antarctic land and ice, forms a ring which almost surrounds and encloses the World Island. If a map is drawn on Mollweide's projection with the marginal meridian at longitude 100° W. and if South America is moved thirty degrees to the west (Fig. 1), the World Island appears at the center surrounded by the ring fence of America at the margin. There is only one passable gap, and that was found first by Magellan four hundred years ago. Men, money, and courage have been lavishly expended in vain to force a "northwest passage" through this ring. The Panama Canal

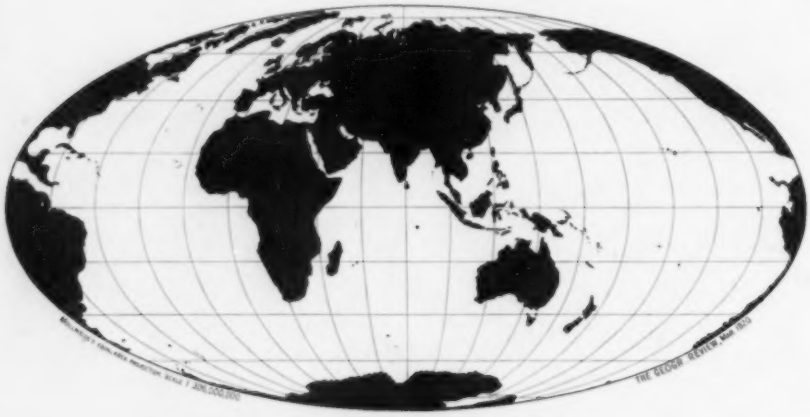

FIG. 1—The World Island and the World Ring.

To Mackinder's "World Island," consisting of the Old World, must be added another great geographical feature to be reckoned with in human history, the "World Ring," or America. This conception becomes clear if a map of the world is drawn, as above, on Mollweide's projection with 80° E. as the central meridian but South America shifted 30° west of its true position—a legitimate device, as it does not alter the essential relation of the New World to the Old.

is an artificial gap which may be passable or not according to the will and power of its guardians. So to the great geographical feature to be reckoned with in human history, the World Island, must be added a second, the World Ring.

To the maker of diagrams license is granted to sacrifice everything necessary to make his one point clear, but he should beware of teaching unnecessary error. Mackinder's diagrams on pages 84 and 88 of his book seem open to this criticism. In attempting to show diagrammatically the relative areas and populations of the World Island and its satellites, he draws a large circle for the island and proportionately smaller circles for the satellites; but he places the satellite circles around the larger one in their relative positions, which is going farther than the avowed purpose of the diagrams allows. North America and South America appear as two widely separated circles; but this implies an unjustifiable error. If the

Americas were shown as a long bar across the page on each side, with circles between them, the diagram would involve only a pardonable sacrifice of the truth. In the Mollweide map herewith the only liberty taken with facts is the straightening of the skew in the position of the two Americas, and the map is diagrammatic in that respect only. Otherwise it is in exact accordance with the facts. This departure places the South American segment of the World Ring in line with the North American segment, a little farther from the World Island on one side and a little nearer to it on the other, and in no way modifies the essential fact of the existence of the ring.

Its Potentialities

The American ring fence, merely as a passive, physical barrier, counts for much. But it is several thousand miles wide, and its natural resources make it a home for men not inferior to the best parts of the World Island. Even if manned by only 200,000,000 capable people, it is a world factor not to be overlooked. In the past America has been content to play the part of a remote satellite of the World Island, but recent events indicate other possibilities for the future. It would require a prophet with truly divine inspiration to forecast her rôle in the drama of mankind. Some general considerations which will influence it are obvious. Her relations will necessarily be much closer with the peoples of the coastlands of the World Island than with those of the Heartland and closer with the European Coastland peoples than with the Monsoon Coastland peoples. This is not only on account of lesser and greater distance but still more on account of ties of consanguinity and culture. America may protect the European Coastland from attack in the rear and may provide an open road for the transfer of reinforcements between it and the Monsoon Coastland. America has no barbarous Heartland, and the people of her more densely populated coastlands are united to a degree unknown in the Old World. In their hands her resources fit her to become a productive and secure base for sea power and man power. American lands and peoples may be sufficient to turn the scale in favor of the powers with which they are allied. If and when the real Armageddon comes, even if the forces of the Old World Heartland are organized from Germany to Japan, the children of light may find themselves backed by an outer line of defense which the powers of darkness will be unable to break.

It is hoped that sometime Sir H. J. Mackinder will use his brilliant powers to make a really world-wide generalization and give us a map which will show the lands and peoples of the globe in the relations not of the past but of the future.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of March. A semi-monthly meeting of the American Geographical Society was held on Tuesday evening, March 9, at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. The lecturer of the evening was Professor Henry E. Crampton of Columbia University, curator of invertebrate zoölogy at the American Museum of Natural History; he delivered an address entitled "Among the Islands of the South Seas" which dealt with his expeditions to the South Pacific in the years 1906 to 1909. On March 23 a monthly meeting of the Society was held. President Greenough presided. He submitted the names of 12 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Dr. Fay-Cooper Cole, the anthropologist of the Field Museum of Natural History, Chicago, delivered an address entitled "Glimpses of Japan."

NORTH AMERICA

The Country's Health. Geographers on the one hand and public health officials on the other are more and more realizing the intimate relation between geography and health. Therefore geographers ought to know of the little bulletin which has recently been inaugurated by the Metropolitan Life Insurance Company of New York. It bears the dry title of *Statistical Bulletin*, but "The Nation's Health" would better express its distinctly interesting character. The records of the company furnish a general survey of the health of the country as a whole. On this basis the editor of the bulletin prepares little articles stating the outstanding facts for the preceding month. For example, a page of the February bulletin is devoted to the difference between the influenza epidemic of 1920 and the far worse epidemic of 1918. Then a half page discusses the unusually low mortality during January, 1920. This favorable condition is rather surprising since the prolonged low temperature, at least in the East, would lead to the expectation of a high death rate. Perhaps the widespread cover of snow and the consequent freedom of the air from dust offers the explanation. Other articles castigate us for allowing such things as epidemics of diphtheria and explain the favorable decline which tuberculosis continues to show. A particularly interesting table shows the extent by which the average life would be lengthened if we could stamp out tuberculosis. For example, if there were no tuberculosis, the average boy 10 to 15 years of age would have the prospect of living about four years longer than he has at present. This, like many other conditions of health, has a geographical bearing, for one of the chief cures for tuberculosis is the right kind of air. If future issues are as interesting as the first ones the *Statistical Bulletin* is well worth keeping in touch with. ELLSWORTH HUNTINGTON

Weather and the Winter-Wheat Yield in Ohio. A recent number of the *Monthly Weather Review* (December, 1919, pp. 841-847) contains the results of a statistical study, by T. A. Blair, of the weather factors affecting the yield of winter wheat in Ohio. Because of the difficulty of securing extensive data for other elements, it is necessary to deal chiefly with temperature and precipitation values. Because of the relatively large and well-distributed rainfall of Ohio, temperature variations have more influence than precipitation variations.

For the state as a whole correlations of monthly weather values with the "condition" reports of the Bureau of Crop Estimates and with the reported yields show no very close relationships. The correlations with condition give a general indication that a wet autumn, a warm and dry winter and spring, especially a warm March, and a cool and wet May are the most favorable weather conditions. Yield correlations suggest a warm March and June and a cool and dry May as the only important requisites for a good yield.

In Fulton County, in northwestern Ohio, and in three counties in the central part of the state, certain ten-day periods in April, May, and June are found to exert a more effective influence on the yield than all other weather conditions combined, except that in Fulton County the March snowfall is also an important factor. It is weather conditions during these ten-day periods, especially temperature conditions, that largely determine yield. R. DEC. WARD

Snowfall on Mt. Rainier. Daily records of snowfall were kept during most of the season of 1916-17 at Paradise Inn, on the southern slope of Mt. Rainier, at an elevation of 5,500 feet. Although the observations were not begun until November 24, 1916, the total depth of snowfall from that date up to the last snowstorm before midsummer, in 1917, was apparently greater than that for any other station in the United States for any entire season, with the single exception of Tamarack, Cal., in 1906-07. This interesting fact is reported by Lawrence Fisher, in a recent discussion of the snowfall on Mt. Rainier (*Monthly Weather Rev.*, Vol. 46, 1918, pp. 327-330). The Rainier snowfall, above referred to, was 789.5 inches. Other very heavy snowfalls previously recorded in the United States are as follows: Summit, Cal. (7,017 feet), 1879-80, 783 inches; Musick Station, Ore. (5,000 feet), 1912-13, 612.7 inches; Tamarack, Cal. (8,000 feet), 1906-07, 884 inches; summit of Pike's Peak (14,134 feet), 1892-93, 743.3 inches.

The record at Paradise Inn is the first which has been obtained west of the summit of the Cascades in Washington at so great an elevation. The railways cross the mountains at comparatively low elevations. The highest mining camps where observations have been made are on the eastern (leeward) slopes of the Cascades. The season of 1916-17 does not seem to have been one of unusually heavy snowfall, judging by the records at other mountain stations. Nor is Paradise Inn located at what would theoretically seem to be the region most favorable for a maximum precipitation. At the elevation of the inn the snow usually disappears in the summer. Above it are the permanent snowfields, and snow falls at times when rain occurs at the inn. It seems likely, therefore, that the maximum annual snowfall will eventually be found to occur at a greater altitude than 5,500 feet.

R. DEC. WARD

EUROPE

The Distribution of Population in Southern Macedonia. Southern Macedonia, which epitomizes in itself the geography of the Balkan Peninsula as a meeting point of regions and peoples (see the article "The Natural Regions of the Balkan Peninsula" in this number), is especially deserving of an intensive geographic study. The profitable pursuit of such a study is suggested by Captain A. G. Ogilvie in his paper "A Contribution to the Geography of Macedonia" in the January, 1920, number of the *Geographical Journal*. It is stimulated further by the probabilities of rapid transformation of the region as a result of recent political events. Probable changes in the distribution of the population are forecast by Captain Ogilvie.

The region is one of a strongly contrasted relief of plateaus and basins. The basins, all of tectonic origin and formerly lake-filled, are now terraced and floored by alluvial deposits. In them the water table is never far from the surface, and water may be obtained from wells sunk anywhere, an important matter in a climate of light rainfall tending to summer drought. On the crystalline rocks of the plateaus springs are far apart; and, as on the chalk of Picardy, villages are perforce grouped round them, empty spaces intervening. In the hills, furthermore, agriculture is intermittent, and a constant fight is made against the scrub vegetation. Yet in this essentially agricultural land the inequalities of population distribution are nothing like so pronounced as one would expect. The basins, it is true, are the centers of life and communication, and they claim the largest and most prosperous villages; but the population on the plateaus is surprisingly dense. Political circumstances are largely responsible. Given a normal development under stable government and conditions of security, population will be naturally attracted to the plains.

The available agricultural area in the basins may be increased by drainage of the swamps. At the same time this will help towards the elimination of malaria, which, says Captain Ogilvie, is "responsible for the bad name of the country as much as the proverbial state of political unrest." Irrigation should be organized and regulated. While certain crops, rice for example, can only be grown under irrigation, everywhere in the plains agricultural values will rise with irrigation. It is already practiced in the Struma valley and on some of the larger alluvial fans. The late Turkish landowners of the big *chifliks* of the plains have already disappeared, and there is opportunity for creation of an equitable system of land tenure. Release of the land from the Turkish yoke should also bring about improvement in agricultural methods and the introduction of modern practices to supersede the primitive methods exemplified by the general use of the wooden plow, the mattock, and the sickle. A number of Greek-owned farms with their specialized devotion to one crop—tobacco, rice, cotton, or cereals—show the possibilities of the fertile plains.

Agriculture and population, however, have probably reached their maximum extension in the hills. Here large areas may most profitably be restored to their pristine

forest cover of valuable timber—oak, beech, chestnut. Elsewhere upland scrub country should be devoted as now to the raising of sheep and goats. At present the pastoral pursuits of southern Macedonia are largely conducted by the migratory Kutzo-Vlakhs. In the redistribution of lands care must be taken to reserve winter pasture for the nomads and their flocks in the plains. With the substitution of modern fishing craft for the present archaic types and with the improvement of harbors the maritime population will also gain. Of course, bound up with general progress will be the improvement of the means of communication, now so sadly deficient.

POLAR REGIONS

Norwegian Surveys in Spitsbergen during 1919. The systematic survey of Spitsbergen by Norwegians begun in 1906 and since 1911 carried out annually, as described in the *Geographical Review* (Vol. 8, 1919, pp. 216 and 218), was continued in the summer of 1919 under the leadership of Adolf Hoel. The party comprised three surveyors, two hydrographers, and two geologists. The land between Horn Sound and South Cape (West Spitsbergen) was surveyed, and complementary surveys were carried out around Bell Sound, the total area mapped amounting to 520 square miles. Simultaneously the hydrographic survey was extended from the northern entrance of Bell Sound to the mouth of Horn Sound. Soundings were taken along this coastal section to a distance of 10 to 20 nautical miles off shore. The area hydrographically surveyed during the season is estimated to be 1,620 square miles. The geologists worked principally in the coastal strip between Horn Sound and South Cape; there for the first time they found fossils (crinoids) in the Hecla Hoek formation (locally metamorphosed Silurian rocks). In 1919 the Norwegian Hydrographic Office published a very valuable chart embodying the Norwegian hydrographic surveys of the Spitsbergen coasts to 1918. It is entitled "Nordishavet fra Norge (Tromsö og Varanger) til Spitsbergen" (The Arctic Ocean from Norway (Tromsö and Varanger) to Spitsbergen). The meridional scale is 1:100,000 in 76° N. It differs noticeably from the British Admiralty chart of these waters in the representation of the coast line and the outlines of the fiords. It also contains a great many new soundings on the bank north of Bear Island and off the western coast of Spitsbergen. This chart will be of great value to geographers.

CHARLES RABOT

Completion of Rasmussen's Study of the Greenland Eskimos. Knud Rasmussen, the well-known Danish explorer whose activities have been reviewed from time to time in the *Geographical Review* and the account of whose 1916-18 expedition to northern Greenland was published in the August and September, 1919, numbers, returned late in 1919, according to information received by the undersigned, from Ammassalik, the only settlement of any consequence on the east coast of Greenland. This visit to Ammassalik completes Rasmussen's study of the Eskimos of the entire Greenland coast. He has visited every group from Ammassalik to Etah and knows every Eskimo in Greenland personally. It is safe to say that no one has ever come into such direct intimate contact with a whole people as he has. Part Eskimo himself, born and partly educated in Greenland and trained in languages and ethnology in the University of Copenhagen, he has been especially well prepared to make this study, and he has devoted his life thus far to that work and exploration. It is his ambition to make a comprehensive comparative study of all the Eskimo race from Ammassalik to Siberia.

In his visit to East Greenland he has studied the culture and the language of the East Greenland Eskimos in relation to those of the Eskimos on the western coast of the great island. This comparative study has revealed many facts of noteworthy significance, which he intends to present in the near future. He was surprised to find that the East Greenland Eskimos preserve many of the customs of the Central Eskimos, who still inhabit the ancestral home of the race about Hudson Bay. He found that they are more closely related to the Central Eskimos than are any of the other tribes of the entire Greenland coast and that they have only recently been affected by contact with the Greenland west-coast culture.

Rasmussen made collections of their traditions and folk-lore, of their cats' cradles, and of their artifacts. He studied their language and their customs very closely in order to determine their relationship to the other tribes of Greenland. He states that, though the Ammassalik Eskimos have been superficially very much modified by the Danish administration of the settlement, they are at heart the same primitive people that they were before the coming of the white man. In the immediate vicinity of the settlement they have adopted Danish ways, but as soon as they leave the vicinage of the

trading station they lapse into their old primitive life. The outlying settlements are as typically Eskimo as they ever were.

With his characteristic directness and insight into Eskimo character, Rasmussen has penetrated deeply into their culture and history. He expects soon to publish the results of this latest expedition in full, and though it has not been of a spectacular or popularly attractive character he thinks that it will yield a wealth of scientific material.

W. ELMER EKBLAW

PHYSICAL GEOGRAPHY

Desert Erosion as Illustrated by a Comparison Between the Algerian Sahara and the Libyan Desert. The development of land forms in a humid climate has been thoroughly worked out, but the evolution of the topography in an arid region has not been as satisfactorily explained. Professor W. M. Davis has sketched the main lines of probable development, but he has left to others the task of amplifying and verifying his account and of finding examples of deserts in the varied stages of development.

M. E.-F. Gautier, in a recent paper entitled "Deserts Comparés" (*Ann. de Géogr.*, Nov. 15, 1919), helps to fill in some of the gaps in our knowledge of deserts from the physiographic point of view. He is thoroughly versed in the topography of the Algerian Sahara, and during a few weeks' reconnaissance in the Libyan Desert was struck by the difference between the land forms of the two deserts. This difference he interprets as signifying that the Libyan Desert is in a much later stage of development than the Algerian Sahara, and his description of the relative topography of the young and old deserts is extremely interesting.

The first evidence he brings to support his theory is drawn from the results of fluvial erosion, the *weds* (*wadis* in Egyptian Arabic) of Algeria, the oases of Egypt, and certain delta deposits which are found in Egypt. The *weds* are dry watercourses, related to each other in the same way as are the stream beds of a humid region, tributary channels, graded in size and gradient, leading to trunk streams, etc. The oases on the other hand are basin-like depressions, surrounded by a more or less continuous escarpment, and no trace of a former river system is apparent. Evidently there have been streams in Algeria during a comparatively recent period, while the Libyan Desert has suffered wind erosion for a far longer time. The same conclusion may be drawn from the study of the extensive delta deposits at Wadi Natrun and Moghara. These deltas are of Tertiary age and must have been accompanied by great fluvial erosion. The leveling of all trace of the great valleys corresponding to the deltas could only be accomplished by wind erosion continued during a very long period. The complete absence of all trace of a valley system contrasts strikingly with the fresh-cut Quaternary valleys of Algeria.

The part of the evidence based on fluvial erosion leaves little to be desired; the rest, however, is not as convincing. The character of the Oligocene deposits is next examined. In Algeria these deposits consist of vast alluvial plains, whereas in Egypt the alluvial deposits have been so thinned by wind erosion that often the level bare rock floor of the desert, scoured by the wind, is exposed. These observations, taken in connection with the work of McGee in the Sonora desert, suggest that the later phases of desert physiography may be characterized by bare level expanses where the bed rock is exposed. Before, however, this piece of evidence can be taken to indicate the relative age of the two deserts in question one must be sure that the deposits compared are of the same date, and this is still problematic, the "Oligocene" having been applied provisionally.

The next piece of evidence is that supplied by the dunes. Those of the Algerian desert are related to the alluvial plains. Where there are wide expanses, open to the wind, the dunes pile up. The dunes of Egypt on the other hand are distributed much more unevenly. In the eastern part they are confined to a long narrow line of thin dunes, running almost due north and south. M. Gautier hazards the suggestion that this line may mark the frontier between the natural regions which were once to be differentiated in the Sahara, i. e. the desert in the east and the humid area in the west.

According to M. Gautier's theory this division of the Sahara existed when the Quaternary valleys of Algeria were cut. The dunes of the eastern part of the Sahara are very different again. They are piled up to such an enormous thickness and cover so extensive an area that the land is hardly known. The dunes are as different as possible from the smaller masses of dunes in Algeria, which are not impenetrable. M. Gautier considers that the greater mass of the Egyptian dunes is evidence that more time has been taken to form them. There are other factors, however, it would seem, that might cause dune-formation to go on more intensely in one part of the desert than in another.

E. M. SANDERS

The Distribution of Maximum Floods. Professor Alfred J. Henry, in charge of the River and Flood Service of the Weather Bureau, read before the American Meteorological Society at New York, January 3, 1920, a paper on "The Distribution of Maximum Floods" (*Monthly Weather Rev.*, December, 1919, pp. 861-867). The records of both American and European rivers show an average of seven to ten great floods per century. Such floods are primarily due to precipitation, and the precipitation, in the form of rain, which produces floods may be of two distinct types: (a) so intense and widely distributed as to produce flooding regardless of antecedent conditions; (b) moderate rains continued intermittently for eight to ten days or more with antecedent conditions favorable to a high run-off.

There appears to be no orderly progression in the magnitude of floods with the lapse of years, i. e. the absolute maximum flood of any 100-year period is not necessarily greater than the absolute maximum flood for the preceding 100 years. The magnitude of great floods with respect to the average annual flood seems to increase in a geometrical progression but apparently wholly regardless of the march of time. Further, great floods, like great rainfalls, are essentially a local phenomenon, even for the same stream.

R. DEC. WARD

GEOGRAPHICAL REVIEWS

After-the-War Economic Problems

J. E. Barker. **Economic Statesmanship: The Great Industrial and Financial Problems Arising from the War.** ix and 408 pp.; index. John Murray, London, 1918. 8½ x 5½ inches.

The larger part of this book is given to a consideration of the after-war problems of the United Kingdom. After an introductory chapter on "Coal, Iron—and the Domination of the World" the author seeks to show the relative unimportance of the British war debt. He emphasizes very justly the probability that depreciation of money will do much to lighten the burden, and in succeeding chapters he aims to prove that this burden can readily be borne by a reform in British methods of production. He spent six months in the United States and Canada, and in the light of his experience he urges his countrymen to follow American examples in agriculture, in transportation and manufacture, and in education and research. He would introduce also the protective tariff, which he discusses particularly with respect to its effect on Lancashire and on the shipping trade.

Later chapters discuss the position and future of other countries. The statistics of population and production in France are analyzed to show that that country must be given not only Alsace-Lorraine but also coal from the Ruhr field if it is to maintain its economic position. Italy appears to the author to be in more serious straits, and he sees little probability that in the territorial gains likely to result from the war Italy will satisfy her need for elbow-room and for raw materials. He advances the bold suggestion that the United States and the British Empire should make a free gift to Italy of the needed territory, which he does not more particularly specify. Two chapters cover the ability of Germany to pay a war indemnity, and the final chapter is given to "The Future and the Natural Resources of the United States."

The author is an interesting figure in the world of the English monthly reviews, for which he writes frequently and in which most of the chapters of the present book first came out. He was born in Germany and first published his "Modern Germany" under the name of Eltzbacher, the name appearing as Ellis Barker in later editions. Now he is more British than the Britons. He has a keen eye for good material in original sources, especially statistics, which he cites liberally. He is a deft writer, challenging the attention of the reader by bold generalization and pressing his attack (for he is always aggressive) with a wealth of quotation and illustration. His observations are often shrewd and enlightening; but when he has had his say his assertions often remain still to be proved. He is careless in matters of fact, he handles statistics in an impressionistic manner that makes them often entirely misleading, and he pays little regard to considerations that can be urged against his views.

He measures the productiveness of different branches of activity by value of gross output, with no allowance for raw materials consumed. By this method of measurement the product of American manufactures in 1909 was twenty billion dollars instead of twelve billion. He counts as present wealth in England and Germany the value of the coal deposits, multiplying the estimated tonnage by the price at the surface, with no discount for the time required to get the coal up. He compares English and American transportation rates with no allowance for the difference in the length of the haul or the character of the service. He says that the building of the American railroads was powerfully assisted by the cheapness of iron and steel due to the American policy of high protection. Tariff reform will raise British wages: "Universal experience has shown that the introduction of a tariff has that effect upon the wages of labour" (p. 222). "The doubling and quadrupling of the Imperial railway mileage will undoubtedly double and quadruple the number and the wealth of the Empire's white population" (p. 89). The possibilities of production appear to him in general to be unlimited; he does not know any law of diminishing returns, and Malthus is to him "a well-meaning but fantastic clergyman who dabbled in political economy." Yet when he discusses any particular country he finds its resources limited, and Italy in particular is overpopulated. The American Federal Government appears as an all-wise and farsighted guardian of the material interests of its people. American professors are kept up to their work by the insecurity of their tenure. "Life professorships with pensions after retirement on the European model are practically unknown" (p. 155).

A comparison of the figures of a table on pages 187-188, designed to show that American industrial workers produce three times as much per head as corresponding

British workers, with the figures given in the Final Report on the First Census of Production [Cd. 6320], a British bluebook published in 1912, shows how careless the author is in statistical compilation. In the cardboard trade he excludes the value of "other" products but includes the wage earners engaged; in the paper trade he includes salaried persons with wage earners; in the cement trade he has 18,860 wage earners where the census has 13,860; in the cotton trade he gives a value of £132,000,000 where the census gives £162,000,000. These discrepancies appear in a comparison of part, not all, of the items. Such errors, particularly when they all contribute to support the author's thesis, as in this case they do, destroy all confidence in his work. CLIVE DAY

A STUDY OF TRADE FLUCTUATIONS

D. H. ROBERTSON. **A Study of Industrial Fluctuation: An Enquiry into the Character and Causes of the So-Called Cyclical Movements of Trade.** xiii and 285 pp.; diagrs., indexes. P. S. King & Son, Ltd., London, 1915. 7s. 6d. 8½ x 5½ inches.

Industrial fluctuations are sure to play an important part in the future just as they have in the past. Therefore, although the war prevented an earlier review, Mr. Robertson's book is worth discussing at this time. It is also worth discussing as an example of the way in which careless handling can spoil a fine subject and largely nullify a great amount of careful research and clear thought. The book is packed with important and pertinent facts as to industrial fluctuations in many countries, especially Britain. It also has the excellence of being built around a definite theory and yet of giving the facts in such a way that the reader can decide for himself whether to accept or reject the theory. In brief the author's contention is as follows: After a period of industrial depression a recovery occurs from the following causes: (1) increased efficiency in production because of lessons of economy and industry learned during hard times; (2) increased natural resources either in the form of good crops or of larger supplies of coal, iron, lumber, and other products which depend largely on geographical surroundings. This increase in nature's bounty causes a relative increase in the value of manufactured articles. (3) Recovery also occurs because of increased hope that future profits may accrue in some of the following ways: (a) because the machinery and other equipment of all kinds which has been worn out but not replaced during the period of depression must be renewed, thus creating a great demand; (b) because of geographical or industrial discoveries; and (c) because of new inventions or new political arrangements. (4) The last of the causes of industrial recovery is the expansion of currency and credit, either through the opening of new gold mines or otherwise. Such expansion leads people to expect a rise in prices in their own particular commodities, and it also lowers interest rates and causes the ultimate consumer to purchase freely. The subsequent decline in business comes through the reversal of these four processes. Space forbids further discussion, but the prominent place occupied by geographical factors is evident.

If Mr. Robertson's book were well written it would be worth reading by a large circle of geographers. Here is a sample of its style: "When fairly faced, the problem of industrial fluctuation becomes nothing less formidable than the problem of maximising the community's aggregate of net satisfaction through time, in other words of attaining the best distribution through time of its income of consumable goods which is practicable without undesirable restrictions of the total of that income." This is not scientific language: it is jargon. To ferret out the meaning is like pulling teeth, even for the economist. Presumably the author means: "When fairly faced, the problem of the prevention of industrial fluctuation becomes the formidable problem of giving the community the maximum amount of satisfaction. That maximum is not attained by overproduction alternating with underproduction, but by maintaining an intermediate level. This can be done without the undesirable result of reducing the average production below its present level."

It is to be hoped that some day Mr. Robertson will put his interesting theories into such language that readers can concentrate their attention on the ideas and not be forced to expend it on the words. ELLSWORTH HUNTINGTON

LAND GRANTS TO SOLDIERS

F. C. HOWE. **The Land and the Soldier.** xi and 196 pp. Charles Scribner's Sons, New York, 1919. $1.25. 7½ x 5½ inches.

The theme treated interests all our people; it is closely connected with the future welfare of the nation. Sixty years ago any poor man in our country who had gumption and good health could get land for little or nothing. At first the government charged him $125 for a quarter section. A little later, under a new law, he could take up the

same area of government land as a pre-emption claim at a cost of only a few dollars for the necessary papers. Farms thus acquired within 25 miles of Minneapolis and St. Paul, for example, are now worth $25,000 or more, and the farmer can market his produce and get home in his auto-truck in a half a day.

Poor men cannot pay these big prices for land; and the government is already beginning to help the soldier with little or no money to get hold of a bit of land on which he can support his family when he has one. The government will also see that he has a little house and that other needs will be supplied. When he is able, he will be expected to pay for this.

There are many other men, not soldiers, who will wish to make homes and acquire a few acres so that they and their families may be comfortable. All sides of the great question are discussed in this book. It treats of many phases of acquiring and developing small farm properties and tells of the experience of Denmark and other countries that have made a great success of small-scale dairying, poultry raising, and other farm enterprises and are happy and prosperous. CYRUS C. ADAMS

A GEOGRAPHICAL HANDBOOK ON POLAND

E. WUNDERLICH, edit. **Handbuch von Polen (Kongress-Polen): Beiträge zu einer allgemeinen Landeskunde.** 2nd edit. xxxii and 511 pp.; maps, diagrs., ills., bibliogr., index. Dietrich Reimer (Ernst Vohsen), Berlin, 1918. 11 x 7½ inches.

Warsaw fell before Hindenburg's armies August 5, 1915. Early in 1916 the German governor-general of Warsaw ordered a comprehensive work written on Congress Poland, which means the region called Kingdom of Poland by the Congress of Vienna in 1815. It is the part of Poland that fell to Russia and is therefore quite separate from the portions of that country long included in Prussia and Austria. The name Congress Poland is meant to make this clear. In January, 1917, the "Handbuch" was first issued, and the edition was exhausted in a few months, exciting interest "even in Polish circles." This second edition was issued in January, 1918. During all this time Congress Poland was occupied by the German armies; but the Germans had intimated that they meant to make this territory independent. The treaty of Brest Litovsk, annexing it to Germany, had not then been signed.

Eight of the fourteen authors represented in this volume were on the governor-general's staff, one representative each of the press and big business, and one expert each for agriculture, geography, physics, meteorology, forestry, and geology—a staff equipment characteristic of German thoroughness. The other six were university men of technical training.

Learned and unlearned Germany had been alike in the dark, we are told, about the nature and resources of this region, so near their territory. The Russians had kept investigators out and had discouraged studies by the Polish inhabitants.

The book is a valuable contribution to the geology, physiography, and economics of the country and contains important matter concerning its inhabitants and their material and cultural condition. Although written on conquered ground for the use of a military governor, it does not thereby differ so much from older German books as might be the case if the Germans had been less convinced of their superiority to all other races. It is thorough and clear, makes much use of Polish and Russian sources, and shows personal investigation by the authors. The authors try to maintain an impartial and scientific attitude. It evidently has not occurred to them that their work is propaganda. That there has long existed a hatred of the Germans in Congress Poland is recognized. This hatred is explained as being due to characteristic intrigues of the Russian government. The work of Dr. Schultz and Dr. Praesent on the people of the region shows their belief—not explicitly stated—that the one thing these people need is the protection and guidance of the German government. The governor-general says he was well pleased with the book.

The Germans had no idea there were so many of their countrymen in Congress Poland (719,000) nor that they had preserved their habits and speech so well. Dr. Praesent was astonished to find near Lodz numerous purely German villages masquerading under Polish names.

Of old the Poles were herdsmen in the forest or forest openings. German peasants came in in the thirteenth and fourteenth centuries, cut the forests, and founded innumerable villages and cities in which the Polish nobles, in their gratitude, allowed them to enjoy the freedom customary in German cities. They tilled the land and taught the Polish peasants to till it. There were great numbers of these German peasants, they made the land valuable to the nobles who owned it; but, though eagerly invited, they were soon merely tolerated and then oppressed. The country became a great producer of grain; but the nobles attached the peasants to the soil in order to

keep their labor, and a period of waning prosperity followed. The emancipation of the peasants in 1864 and the introduction of modern tools and methods since then have given agriculture a great impetus. Again, at the beginning of the nineteenth century, when the Czar wished to manufacture Russian raw materials within Russian territory and invited German weavers and other artisans to come to Lodz to establish factories, Germans came in great numbers and inaugurated the era of industrial prosperity that distinguished that corner of the Czar's dominions. Lodz, which had less than 1,000 people in 1820, has now 500,000, though it has no single feature other than the Czar's whim to make it a suitable site for an industrial city. These two services of the Germans, the introduction of agriculture and of industry, have never been properly appreciated in Germany!

The Poles are said to be bright, cheerful, excitable but not liable to become ugly under excitement, and very patriotic. At work, however, they are clumsy and lack persistence. Polish manufacturing processes and products were unnecessarily costly but enjoyed a vast market in Russia that would be lost in the event of Polish independence; yet it was thought that under better management economies would make it possible to market products within the country.

A peculiar feature of the agriculture of the land is that more than half of it is occupied in small farms by families so large that they consume their whole product. Although two-thirds of the people are agriculturists, the country had to import grain from Russia. The war, by cutting this off and causing inevitable devastation, brought distress! Briefly, but in quite another tone, we read of the "unutterable sufferings" the war brought to the Germans in the country.

The forests have been badly handled, wood being exported in times of scarcity. The best industrial region is south of Lodz, near the coal mines. The mines produced 7,000,000 tons yearly as compared with 44,000,000 tons in Upper Silesia. The capital employed in industry was mostly foreign, mostly German one gathers, though the amount is withheld in a statement that assigns 60,000,000-70,000,000 rubles to France, 15,000,000-20,000,000 to Russia, and 5,000,000 to England.

Next in number to the Poles are the Jews, speaking Yiddish, which is really a modified German, though more of them came from the East than from the West. These 2,000,000 Jews are of low culture, filthy in their habits, and form a majority of the inhabitants of the cities, except Lodz and Warsaw. Russian law forbade them to live in the same villages with Russian farmers. Some of them are factory hands or travel as itinerant tailors, cobblers, or carpenters—a great deal of handwork being customary—but mostly they are peddlers, traders, shopkeepers, or bankers. It was characteristic that in Warsaw handmade shoes were cheaper than the local factory product.

In short, Congress Poland is a transition state between Germany and Russia. Germans, though resisted by Russia, had given it what share of modern culture it possessed. These Germans, intelligent factory hands and farmers, constituted 5 per cent of the population. 75 per cent were Poles, ignorant, inefficient, and amiable; 15 per cent Jews, dirty and ignorant; and 5 per cent Russians and Lithuanians.

MARK JEFFERSON

MINERAL RESOURCES OF SOUTH AMERICA

B. L. MILLER AND J. T. SINGEWALD, JR. **The Mineral Deposits of South America.** ix and 598 pp.; maps, diagrs., ills., bibliogr., index. McGraw-Hill Book Co., Inc., New York, 1919. $5.00. 9½ x 6 inches.

A thoroughly praiseworthy piece of work has been done by these two authors, who have not merely compiled a list of mineral localities with some comment on the petrography of South America but have also conceived their problem in a broad way and have written informatively. The material is arranged in alphabetical order by countries. There is an introductory section on the physiographic divisions of South America, and the description of each division includes a brief statement of the topographic features, the rocks, and the mineral deposits of economic importance. The discussion is necessarily brief and, from the geographical standpoint, less interesting and valuable than the geographic sections under the several chapters that deal with the countries of South America.

While the absence of geographic features in a book on mineral topics does not constitute a fair basis of criticism, one cannot help remarking that the topographic features are described quite empirically, with no mention at all of physiographic history and no generalization regarding topographic form. The descriptions of the Andes run like the descriptions of the older textbooks, according to mountain chains, mountain heights, passes, etc. The result is that one obtains no adequate picture of the topography of South America as a whole or of the several countries. It would have required no more

space to have described the features in terms to permit generalizations to be made. Certainly if any description at all is given it should be in the form that even a geologist would find useful. Nevertheless it must be said that no similar work has been published and that the material is put in such convenient form that a valuable service has been rendered by the authors in publishing their book.

European Tornadoes

Alfred Wegener. **Wind- und Wasserhosen in Europa.** xi and 301 pp.; maps, diagrs., ills., bibliogr. (Series: Die Wissenschaft: Sammlung von Einzeldarstellungen aus den Gebieten der Naturwissenschaft und der Technik, Vol. 60.) Friedr. Vieweg & Son, Brunswick, 1917. M. 12. 9 x 6 inches.

Because of the extraordinary intensity and great frequency of tornadoes in the United States, American meteorologists have rather naturally paid very little attention to these phenomena in other countries, as they there occur in milder form and relatively rarely. Thus in one of the standard American textbooks on meteorology we find only the following statement regarding tornadoes outside of the United States: "They are known in less frequent occurrence in Europe and other parts of the world," and in another recent textbook we read "the tornado . . . is peculiar to the United States, although in a slightly modified form it at times occurs in other parts of the world." Even in Hann's monumental and extraordinarily comprehensive "Lehrbuch der Meteorologie" (3d edition), of the 12½ pages devoted to whirlwinds, tornadoes, and waterspouts, 8½ concern the tornadoes of the United States and the remaining 4 deal with these phenomena in other countries. It is, indeed, almost certain that very few of our professional meteorologists have any clear ideas concerning what we call "tornadoes" in other parts of the world.

For this reason we welcome Dr. Wegener's new and very careful study of the whirlwinds (*Windhosen, Tromben*) and waterspouts of Europe. The author has collected, from a wide range of literature, the available observations and descriptions of these phenomena; he has classified and summarized these accounts from the standpoint of their physical explanation; and he has given a clear and withal an interesting discussion of the various characteristics of whirlwinds and of waterspouts. It is nearly fifty years (Reye, 1872) since any attempt has been made to collect and summarize the facts concerning European whirlwinds. Dr. Wegener has expressly limited his study to Europe, as he says in his preface and as his title indicates, but there are frequent comparisons with the phenomena of American tornadoes. The author confesses that he has not been able to collect all the existing accounts of European whirlwinds, partly because of the exigencies of the war. The preface is dated "In the Field," August, 1916.

The portions of this monograph which naturally attract the attention of an American reviewer are those which emphasize the striking differences existing between the mild, infrequent, and relatively safe whirls of Europe and the violent, frequent, and destructive American tornadoes. Thus (p. 85) four years, 1883-1886, brought, according to Finley, 777 tornadoes in the United States, while the four years with the most tornadoes in Europe, viz. 1884-1887, gave only 35. European thunderstorms bring most tornadoes in autumn and early winter and in the morning hours, while in the United States the maximum number of tornadoes comes in spring and early summer, and in the afternoon. Of 89 weather maps on days with tornadoes in Europe, only 49 showed marked barometric depressions. In relation to the particular octant of the depression in which these disturbances are most frequent, Dr. Wegener's figures show this to be east-southeast. The prevailing direction of progression is from southwest and west, as here. The average velocity is about 14½ miles an hour, which is only about one-third of that in the United States. More than one-half of the paths which can be clearly determined for Europe give an average length of between 0.6 mile and 6 miles (1-10 kilometers). The duration of 61 per cent of the tornadoes which have been studied was between 5 and 30 minutes. But the most striking fact about European tornadoes is their very slight destructiveness. Thus loss of life is reported in only 5 per cent of the cases cited; and a liberal allowance for loss of life, which it is impossible to determine with accuracy, gives an average of 0.4 for the number of deaths per tornado. It is surely unnecessary to give any comparative statistics for the United States. Of 25 cases in which the direction of rotation was noted, 18 showed cyclonic and 7 showed anti-cyclonic rotation.

Dr. Wegener has brought together (pp. 275-279) several personal accounts of the direct contact of ships at sea with waterspouts. This particular relation of waterspouts has been much discussed, and there are many exaggerated views in regard to it. A reading of these narratives leads to the irresistible conclusion that waterspouts relatively rarely do serious damage to vessels which come in contact with them.

There are numerous illustrations of waterspouts, some from photographs and some from sketches, including among the former three pictures of the Marthas Vineyard waterspout of August 19, 1896, but there is no half-tone of a tornado funnel cloud. The remaining illustrations include maps, diagrams, and views of Weyher's experiments in the artificial production of whirlwinds. A brief discussion of the various theories regarding the origin of tornadoes and of the other less violent whirlwinds of Europe leads our author to acceptance of the mechanical theory. In this, "the temperature conditions are not considered the primary cause and the rotation the effect, but the rotation, whether produced mechanically or hydrodynamically, is believed to be the cause of the thermodynamic effects, the latter manifesting themselves in the condensation of the funnel cloud."

Dr. Wegener's monograph very satisfactorily fills in a missing chapter of modern meteorological science. It merits careful study. R. DEC. WARD

JAPANESE RAINFALL

TORAHIKO TERADA, TOKEZO YOKOTA, AND SYOHU OTUKI. **On the Distribution of Cyclonic Precipitation in Japan.** 32 pp.; diagrs. *Journ. College of Sci., Tokyo Imp. Univ.*, Vol. 37, Art. 4, 1916. [Author's abstract in *Monthly Weather Rev.*, Vol. 44, 1916, pp. 127-128.]

All well-defined cyclones occurring in the Japanese region, 1905-1915, were used in making two sets of charts: (1) showing lines of equal percentage of precipitation expectation for different locations of cyclones; and (2) for six divisions of each of the three groups—Pacific, Middle, and Japan Sea—showing by lines the percentage rainfall expectation when cyclones are in different positions.

Temperature differences due to latitude here as elsewhere cause precipitation most frequently on the eastern side of the cyclone. The exposure of the Pacific coast to warm east and south winds gives it greater cyclonic rainfall frequency than the cooler Japan Sea coast.

The land side of a cyclone usually has less rainfall than the water side. On the Pacific coast of Japan the northeast quadrant is rainiest, while on the other coast the expectation of rain is about the same in all parts of a cyclone. On the western coast of Yezo, however, as in parts of western Europe, the greatest frequency comes in the southwest quadrant of a cyclone.

In mountainous Japan, Professor Terada emphasizes the topographic effect on precipitation. For instance, when a cyclone is some distance northwest, the expectation of precipitation is greatest on the coasts. On the Pacific side it rains because of the ocean air rising over the shore and mountains, on the Japan Sea coast because of cyclonic action. Topographical influence on the mere occurrence of rain is most apparent when a cyclone is far away: when it is in the southwest, the rain area extends far north on the Pacific coast of Japan; but when in the northeast, the rain area is most extensive southward on the Japan Sea coast.

These results seem strikingly like a description of the cyclonic distribution of precipitation in the eastern United States, where the Appalachians correspond to the Japanese mountains, and the Great Lakes and Mississippi Valley have effects similar to the Japan Sea (cf. in *Monthly Weather Rev.:* W. G. Reed, Vol. 39, 1911, pp. 1609-1615; C. F. Brooks, Vol. 42, 1914, pp. 318-330; H. H. Clayton, Vol. 44, 1916, p. 81, last paragraph and map). CHARLES F. BROOKS

TRAVEL ON THE KANSU-TIBET BORDER

REGINALD FARRER. **On the Eaves of the World.** Vol. 1, xii and 311 pp.; map, ills.; Vol. 2, viii and 328 pp.; map, ills., index. Edward Arnold, London, 1917. 9 x 6 inches.

Mr. Farrer is a student of plant life. He visited the boundary region of Kansu-Tibet from south to north to look for flora that might stand the British climate better than products of the warmer parts of China. He was especially interested in looking for new flowers.

"On our grey mood the dawn came grey and weeping" is a fair specimen of the light, literary touch that permeates the whole work and is responsible for the thickness and weight of the two volumes. There is little geography and no geology in the book, but the author gives hundreds of pages to his travels along the roads, the people he met, and his pleasant and disagreeable experiences. Impressions so lightly gained are scarcely more than skin deep and have little worth in evaluating the essence of a country or people. Some three pages given to the vagaries of Mr. Farrer's cook seem to justify

the discharge of that person, but why should the public be called in to act as jurors in the case?

There are frequent though brief allusions to the author's botanical work. Thirty species that he discovered were new to science, and he brought home some plants whose flowers are strikingly delicate and beautiful. The index to the two volumes covers only a little over four pages and is largely botanical. CYRUS C. ADAMS

A HISTORY OF CHINA

E. H. PARKER. **China: Her History, Diplomacy, and Commerce, from the Earliest Times to the Present Day.** 2nd edit. xxx and 419 pp.; maps, ill., glossary, index. E. P. Dutton & Co., New York, 1917. $2.50. 9 x 5½ inches.

This is a new and revised edition of a work that first appeared some sixteen years ago. It is a volume written by an expert, a profound scholar, a man of long residence in China and of wide experience and keen observation. The book is full of just such information concerning China as the busy man and the business man wants.

The only important matter contained in the first edition which is omitted in this is the chapter on the calendar, now no longer needed since the republic has adopted the Western solar year. Three new chapters have been added: one on "Law," a second on "Language and Literature," and a third on the "Rise of the Republic." The chapters of the old edition which have been retained, however, have been largely rewritten; and much new matter has been added to them, greatly increasing the value of the book.

It would be well if all the cynical critics of present-day China could be persuaded to read Mr. Parker's preface. It sets forth in crisp sentences and confident tones the opinion of one who thoroughly understands the Chinese people and sympathizes with them as few Western men can, although he is not blind to their faults. On the situation as it appeared to him in the early months of 1917 he thus comments:

"Suffice it to say that, although in Europe we seem day by day to hear chiefly of revolts and political squabbles in China, as a matter of fact the 'Eighteen Provinces' are not in such a very parlous condition after all, the chief reason for this modicum of happiness being that China is, as it ever has been, a nation of small owners and hardy cultivators, whose ethical teaching has for 2,000 years past inculcated a spirit of deference and order, a right to self-protection, and a family or clannish detachment from public and political authority."

He notes the great increase in the customs revenue which the recent revision of the tariff will further enhance, and he pays a well-deserved tribute to the work of Sir Richard Dane, who has reorganized the salt gabelle. This bids fair to become, probably indeed has already become, a more lucrative source of income than the maritime customs.

The new material in the chapter on "Geography" contains among other things a notice of the work of the Mission D'Ollone of 1906-09 and calls attention to the volume by Jacques Bacot in 1912. Mention is made, too, of the work by Rev. Samuel Clarke, of 1911. All these deal with interesting problems relating to the non-Chinese tribes of southwestern China.

In his chapter on "Language and Literature" the author unfortunately misses the trend of the evidence concerning the relationship between Chinese and Sumerian, which, as it appears to the reviewer, supports the belief, not that Chinese has been derived from Sumerian, but that both have had a common origin in Central Asia, the gradual desiccation of which region has driven the people to emigrate. The explorations conducted by Pumpelly in 1903 and 1904 have demonstrated the existence of a high degree of civilization there at a period placed at 8000 B. C. E. T. WILLIAMS

THE STANDARD HISTORY OF LONG ISLAND

B. F. THOMPSON. **History of Long Island from Its Discovery and Settlement to the Present Time.** 3rd edit. revised and greatly enlarged with additions and a biography of the author by Charles J. Werner. Vol. 1, 1 and 538 pp.; map, ills.; Vol. 2, 649 pp.; ills.; Vol. 3, 677 pp.; map, ills., index. Robert H. Dodd, New York, 1918. $18.00. 9 x 6 inches.

This book is assuredly a classic. No one can complete the reading of it for the first time without a sense of discovery; for it was not written, like the average history of a limited area by a non-professional historian, with much attention to sequences and very little to the larger relationships. There is almost as much of geography and economics in the volumes as of historical data. Much of it is made up of material of first-class importance to the social as well as to the political and economic historian.

Though written in the early decades of the nineteenth century it compares favorably with Bruce's "Economic History of Virginia in the Seventeenth Century." Over and above these qualities is the rare judgment of the author and the general historical sense which he displayed in his search for and use of the best materials. Washington Irving commended his work as well as George Bancroft, Henry Clay, and William H. Seward.

It is, therefore, a matter of more than passing importance to have a new edition of this work prepared by Charles J. Werner, a member of the Long Island Historical Society, who has also prepared a biography of the author and other additions that still further increase its value. Mr. Werner has wisely added a number of important photographs, a photogravure portrait of Benjamin F. Thompson, the author, and a large folding map of Long Island.

The National Forest Reserves

R. H. D. Boerker. **Our National Forests.** lxix and 238 pp.; map, ills. The Macmillan Co., New York, 1918. $2.50. 8 x 5½ inches.

The author was in the U. S. Forest Service from 1910 to 1917. He is now the arboriculturist in the Department of Parks, New York City. The book is an illuminating treatment of a topic of great public interest. Dr. Boerker speaks of the reckless cutting of mountain forests in France which resulted in devastating floods on the Seine and other rivers and destroyed the fertility of over 8,000,000 acres of tillable land. Most of the damage is not yet repaired. We have suffered, to a small extent, from similar floods; and our annual loss from forest fires has been seventy human lives and from $25,000,000 to $50,000,000 worth of timber. We at last became convinced that "forest conservation can be assured only through the public ownership of forest resources." So we have evolved a national forest policy, and its practical workings, thus far, are most encouraging.

Our national forests consist of lands most valuable for growing timber in the western part of the United States that have not been acquired by private individuals. There are 147 national forests, with a total area of 155,166,619 acres—about one-fifth more than the whole of France—the average national forest comprising about 1,000,000 acres. The timber, water, pastures, minerals, and all other resources are for the use of all the people. They are estimated to be worth over $2,000,000,000 as they stand.

The use of forest and water resources is regulated. The forests are protected from fire and trespass. Agricultural lands are open to settlement, and permanent civilization in the timber regions is resulting. A similar policy has been adopted in the Appalachian region, including the White Mountains; and, by the passage of the Weeks Bill, Congress has voiced the sentiment that the forest-fire problem should be shared jointly by state and nation.

The book describes the administration of the Forest Service, the protection given, the artificial reforestation of devastated areas, and the encouragement to all kinds of business that depend upon national forest resources. The whole story is well told; the half-tones are excellent, but the map is small and poor. Cyrus C. Adams

Professor Barrell's Valedictory

Joseph Barrell. **Sources and Tendencies in American Geology.** *Scientific Monthly*, Vol. 8, 1919, No. 3, pp. 193-206.

It is peculiarly appropriate that this paper should have appeared just at the present time, for it is much more than its modest title indicates. It is a review of achievements in the geological sciences during the past generation, particularly the part taken by Americans in those achievements. Written probably a short time before the author's untimely death on May 4, 1919, it presents a summary of the work accomplished during the period of his activity, as though he had intentionally gathered together the strands of a lifetime's advance in his chosen field, that his survey might be guide and instruction to those who should carry on the task. Furthermore, the closing paragraphs present a brief sketch of the probable future for geology; an outline of the most important problems awaiting solution; a chart that will serve to direct the activities of the coming generation of students in the geological sciences. This is Barrell's farewell address to his colleagues and successors.